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POWER AND GAS

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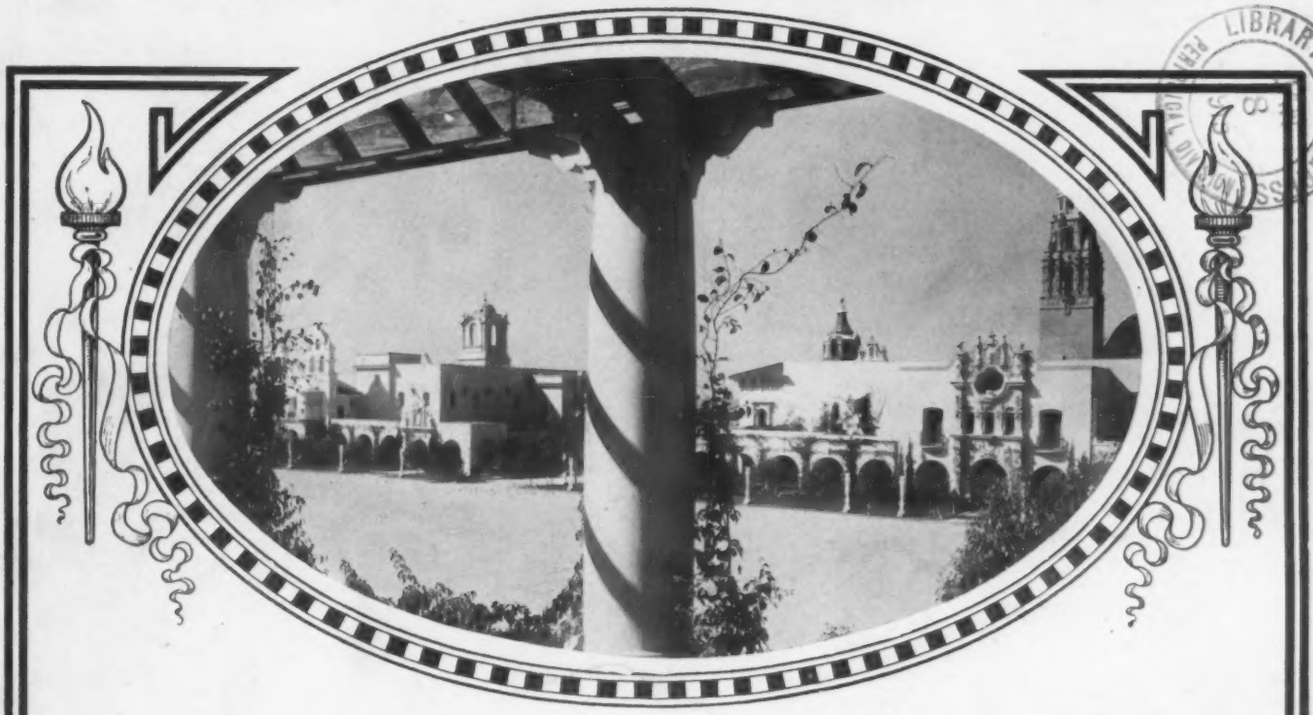

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Electricity at Panama-California Exposition

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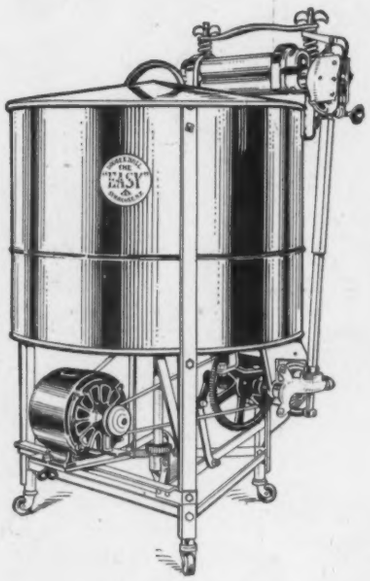
YOU turn the button—electricity and "EASY" Washing Machine does the work



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POWER AND GAS
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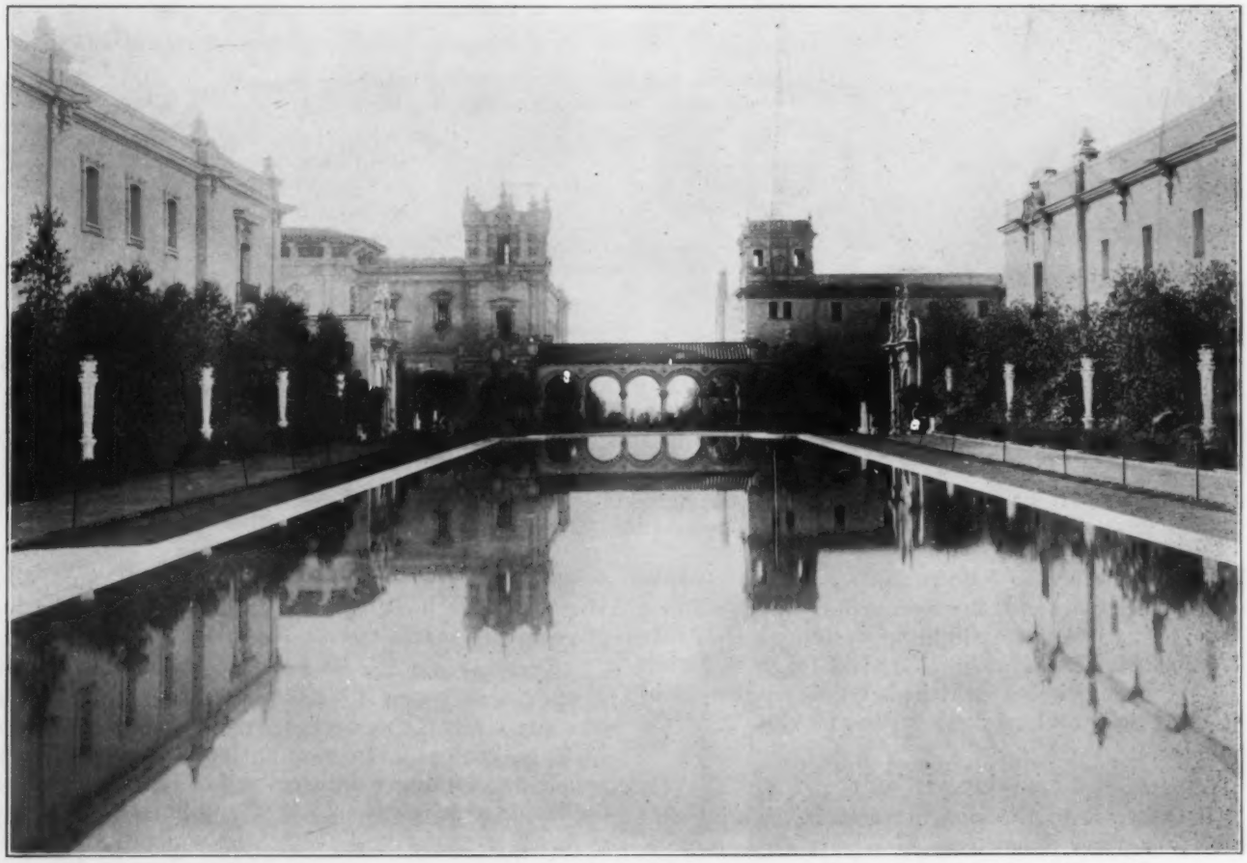
ELECTRICITY AT PANAMA-CALIFORNIA EXPOSITION

When President Woodrow Wilson at midnight, December 31, pressed a small button in the White House in Washington, electricity carried the flash from the nation's capital to San Diego, where the Panama-California Exposition was formally opened on the signal from the Chief Executive of the land.

From the power plant of the San Diego Gas & Electric Company, a 11,000 volt high tension line carries current to the 2500 kw. substation on the grounds of the Exposition. At the substation, the current is transformed to 2200 volts, which is distributed underground to the various Exposition buildings. In



Copyright 1914—Panama-California Exposition La Laguna de los Flores, Showing Lighting Standards on Either Side.

Electricity, in fact, is the modern feature of the new Old Spain which has been built on the mesa overlooking the Harbor of the Sun and the Pacific Ocean. From the clusters of electric lights whose reflection will make the tower of the great California State Building visible for miles around even on the darkest night, to the small electric motor which operates the moving picture machines, electricity is everywhere in evidence throughout the grounds.

practically every building is a transformer room where the current is transformed to 110-220 volt three-phase for power and single-phase for lighting. From the transformer rooms, secondaries are run to the street and arcade lighting systems on the grounds, and to the mains under the buildings.

All distribution on the Exposition grounds is underground except along the Isthmus, where the concessions are located. Here it has been found advis-

able to erect poles along each side of the street but concealed behind the concessions from the eyes of the visitor. Transformers are hung on the poles, and aerial service is made to the backs of the concession structures.

In order to provide individual control for the various distributing systems, there are four circuits running to each transformer room on the grounds.

Copyright 1914—Panama-California Exposition **Looking Toward the Sea from a Spanish Balcony.**

These systems are as follows: First, the three-phase power system; second, the twenty-four hour lighting system; third, the street lighting system; and fourth, the arcade lighting system. The last two will be out during the day, being switched on from the sub-station at dusk and off again upon the closing of the grounds.

Lighting Methods.

In contrast to the system of street lighting followed by former expositions, the San Diego Exposition has found it advisable not to use the outline plan of placing lights on ornaments and cornices. The outline idea not fitting in with the Spanish colonial style of architecture which has been followed in planning and building the Exposition, another system had to be devised.

Along the Prado and streets and surrounding the plazas in the Exposition grounds, are planted the semi-formal black acacia trees 16 ft. apart. On the Prado and the plazas, between every pair of trees, or at thirty-two foot intervals, is placed a lamp post bearing high power Mazda lamps. On the other streets, the intervals between the posts are increased, but nowhere to a distance exceeding 60 ft. The lamp stands 10 ft. 8 in. above the curb. Five hundred watt Mazda globes are used for the street lighting, except on the two of the smaller standards, where ornamental brackets bearing 250 watt lamps are placed, and in the extensive pepper grove, which is illuminated by the series system with 250 candle power nitrogen filled Mazdas. The buildings are 25 ft. back from the line of posts and acacia trees.

Carrying out the Spanish colonial style of architecture, arcades on all the buildings line both sides of every street. The arches have a typical spacing of 13 ft. on center; and centering on each arch in every arcade as an indirect fixture, is an ornate plaster bowl, the inside of which is smoothed and finished in enamel on the plaster itself. Each bowl contains four 25 watt Mazda lamps. The ceiling of the Arcade, which is about 14 ft. high and about 13 ft. wide, has a warm but light tint, which gives an unusually satisfactory reflection. A noticeable feature of the lighting is that, while the finest print can be read with ease, there is not a shadow throughout the whole line of arcades.

The effect of the combined systems of street and arcade lighting is unusually beautiful. Looking down any street the visitor is able to see only the one or two street lights nearest him, the rest being concealed behind the acacia trees, while the arcade fixtures are

also hidden. All the lights, however, are softly reflected on the Spanish colonial buildings of the Exposition, the general effect being remarkably attractive.

On the Isthmus, the outline type of lighting prevails, more than 50,000 ten watt Mazda sign lamps being used in decoration. All these globes are frosted. In some places, where the structure permits, concessionaires are illuminating the fronts of their displays by the indirect system. In such cases, the street is lighted by lamp posts.

Power.

Electric power, of course, is in general use throughout the Exposition buildings in operating mechanical exhibits. The largest amount of current is consumed by the International Harvester Company's indoor exhibit, in which great farming machines are operated exclusively by electricity. In the Southern Counties Building, there is a cotton gin driven by a 40 h.p. electric motor; and in the different buildings are a number of motion picture machines run from d.c. motor generator sets using 220 volt three-phase power.

Among other exhibits using power is one installed by a water company for purifying water by electricity. There are also of course electric adding machines, electric washing machines, electric milking machines, and cream separators, and innumerable other exhibits operated by electricity. Of the current received on the grounds, 2000 kw. is used for power alone, 2500 being used for both light and power.

INDUSTRIAL USES OF FUEL OIL

BY F. B. DUNN.

(Continued.)

Oil as a Fuel for Kilns.

One of the important fields for oil as a commercial fuel is in kilns used in the manufacture of clay products. Enameled, vitrified, fire and common brick, sewer and water pipe, enameled sinks and tubs, cement, lime and cermanic ware of all kinds, as vases and dishes, are all more successfully made with oil than with any other fuel. The principal reason for this is found in the absence of any discoloration due to smoke, soot, or uneven heating.

Three types of kilns are commonly used: the up-draft kiln, the down-draft kiln and the muffle kiln. In the up-draft type the bricks or ware to be burnt

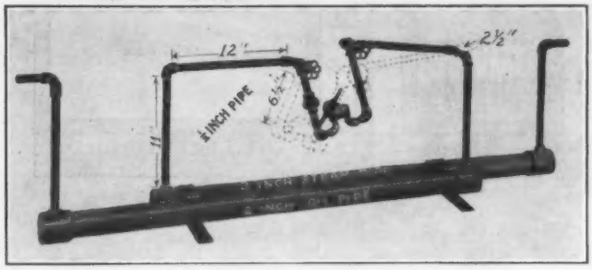


Fig. 45. Burner for Up-Draft Kiln.

are built in arch form in front of the furnace, and staggered throughout the kilns in order to receive an even distribution of the heat. The flame from the burner comes in contact with the brick near the furnace, and as a result a number of bricks become carbonized. Burners fitted to this type of kiln should give a long and narrow flame and many practical men recommend steam for atomizing. They should be adjustable to a low or heavy fire, and fitted with nipples and elbows in such a manner as to direct the flame to any position.

When water-smoking, the burner should always point downward. Because of the low flame required during this period, refractory material should be placed at the point of impingement of the flame, to assist in keeping the fire going and prevent kick-backs or explosions. For a heavy fire the burner should be raised and the oil supply regulated to make a vibrating flame which has a tendency to force the hot gases to the center of the kiln and back to the head. When this is done, the articles in the kiln will be uniformly burned. Fig. 45 shows the correct method of fitting up a burner on an up-draft kiln.

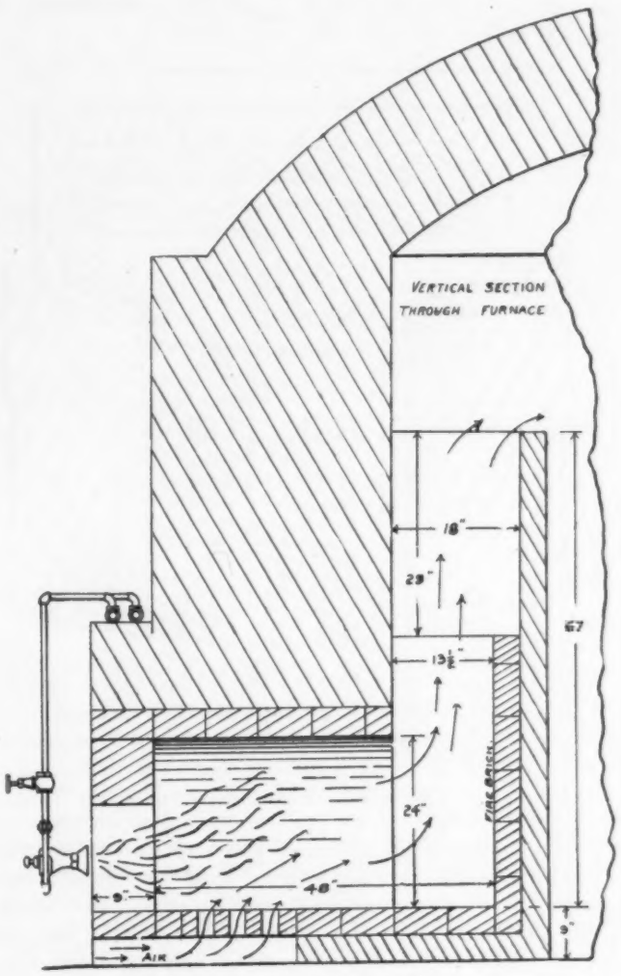


Fig. 46. Down-Draft Kiln.

The following report was taken from the record of a prominent manufacturer of common brick in California:

Type of kiln	Common up-draft
Number of bricks burnt	300,000
Type of burner	Schurs
Pressure of steam at burner	90 lb.
Pressure of oil at burner	35 lb.
Temperature of oil at burner	95 deg. F.
Time required	126 hours.
Total oil consumed	307 1/7 bbl.
Total oil consumed for 1,000 bricks	43 gal.

For comparison, the following report shows the record of an Indiana manufactuer:

Report No. 2.

Type of kiln	Common up-draft
Number of bricks burnt	250,000
Type of burner	Inside mixer
Pressure of steam at burner	80 lb.
Pressure of oil at burner	30 lb.
Temperature of oil at burner	120 deg. F.
Time required	108 hours.
Total oil consumed	422½ bbl.
Total oil consumed for 1,000 brick	71 gal.

A comparison of these reports shows the difference in oil consumption which may be expected with different kinds of clay.

As a rule, the down-draft kiln is more economical and is used almost entirely by manufacturers of crockery and sanitary ware. Fig. 46 shows such a kiln. It will be noted that a baffle wall extends upward in the kiln, thus preventing the flame from coming into contact with the ware. This is the most economical type of furnace construction. Particular attention must be paid to the arrangement and spacing of the brick, to allow proper admission of air for combustion, as shown in Fig. 47.

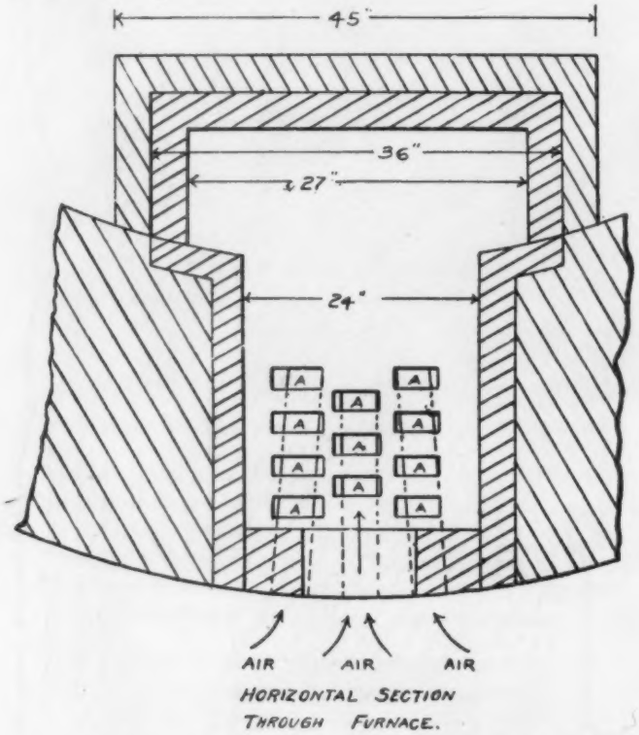


Fig. 47. Arrangement and Spacing of Brick.

Care should be taken in the selection of a suitable oil burner for this type of kiln. It should atomize the oil perfectly and give a short, flat flame, which spreads over the furnace and causes the air for combustion to come up and through the flame. To prevent the burning of the baffle wall the flame must not be long enough to strike it. Air is recommended for atomizing the oil in this type of kiln.

The following report was made by Johnson, Caswell Company, engineers of Los Angeles, Cal., on plant No. 1 of the Los Angeles Pressed Brick Company:

Report of kiln No. 21 of plant No. 1 of the Los Angeles Pressed Brick Company.

This kiln is 38 feet in diameter and 15 feet high from floor to highest point inside. It is equipped with 14 No. 1 burners suitable for down draft kilns.

The kiln was charged with 125,000 cream pressed brick, and the oil consumption was measured by a 2 in. Worthington meter.

Test started at 1:15 p. m., October 31, 1910.
Test completed 5:00 a. m., November 9, 1910.
Total time of test and heat, 106.5 hours.
Water smoking, 7 burners used 16 gallons of oil per hour.
Oil per burner per hour, water-smoking, 2.20 gal.
Oil per burner per hour, high heat, 7.10 gal.
Oil consumption, 14 burners, high heat, 100 gal. per hour.
Average oil consumption for entire heat, 52.6 gal. per hour.
Average oil consumption for entire heat, 3.76 gal. per hour, per burner.
Total oil consumed in entire heat, 10,349 gal. = 246.1 bbl.
Oil consumed per 1000 brick for entire heat, 827.9 gal.
Air used at high heat, 8 cu. ft. per burner per minute.
Temperature at high heat, 2426 deg. F. test cone 10.

The operation of the burners was perfectly satisfactory in every respect, and practically smokeless.

The process of burning fire brick is similar to that of common brick, except that longer time, higher temperature, and much more oil is required. The average time being from 7 to 8 days, and the oil consumption per 1000 bricks varying from 120 to 140 gallons.

The muffle kiln illustrated in Fig. 48 is used by many manufacturers of enamel ware. In this kiln the product is surrounded with a wall that entirely protects it from the direct action of the flame. This type of kiln is necessary where the ware has to be

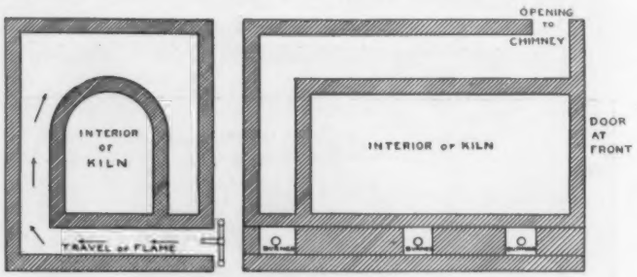


Fig. 48. Muffle Kiln.

treated with two or more coats of enamel, as the second and third coats must be applied when the ware is at a high temperature. A bathtub is a good example of this process. The tub comes from the foundry and is cleaned and smoothed. Then a "filler" coat is applied. This is allowed to set a few days until thoroughly dried. Then it is swung into the furnace by means of a "fork," the temperature of the furnace being 1800 degrees F. As soon as it reaches a "heat," it is taken out and treated with powdered material, and replaced in the furnace until the operator knows that it is ready for the second treatment. The average time required to enamel a bath tub is 24 minutes. A typical muffle kiln has a capacity of 120 tubs each 24 hours, on a consumption of 10 bbl. of oil or 3½ gal. of oil per tub.

The burning of porcelain ware with fuel oil requires careful attention on the part of the fireman. The temperature must be regulated with precision. A common method of determining the temperature is by means of "cones," which are made from a composition of feldspar, kaolnite (china clay), quartz (flint)

ft. high and is heated by means of ten furnaces located at equal centers around the bottom of the kiln. The total time necessary to burn the ware first is 56 hours, the water smoking period requiring from 26 to 30 hours, followed by 22 to 26 hours of "high heat," a maximum of 2500 degrees F. being reached during this period. The kiln is then allowed to cool off gradually for a few days. This size kiln has an average capacity of 2500 lbs. of ware, and from 72 to 80 barrels of oil are use at one burning.

"Fire clay" is an indefinite term, applying in general to clays which do not fuse except at high temperatures. Although no definite limit has ever been set, it may be said that no clay can be called a fire clay of good grade unless it will withstand a temperature of 3000 degrees F. without sign of softening. When burned these clays are generally white or yellow in color. The value of fire clay can only be determined definitely by a refractory test.

The high fire resisting quality of a clay is due to the absence of fluxes, and to the fact that its composition approaches more or less closely to that of the ideal clay substance $Al_2O_3 2Si O_2 2H_2O$. A clay that contains much above 46.3 per cent silicia, cannot, therefore, be a high grade fire clay. When purchasing fire brick the purpose for which it is to be used must be known, for it is impossible to obtain a fire brick which has great mechanical strength, and at the same time is highly refractory. A fire brick which is coarse, clean, white and flinty, is of good quality, and highly refractory. If the grain is fine and smooth, the quality is apt to be poor.

When a boiler setting is required to stand an intense heat and carry a heavy load at the same time, it is well to construct the walls with two courses of fire brick. The inner course should be of highly refractory brick, and the outer course of strong brick. All fire brick should be dry when placed, and only a thin wash of fine clay used for a mortar. The bricks should be "tamped" until in contact with one another; for if a poor quality is used, or if the bricks are not tamped into place, they are likely to melt and run.

After the burning is completed the ware is dipped into an enameling solution, and allowed to air dry. It is then ready for the gloss kiln, which is of the same construction (See Fig. 49.) The same method of placing the ware in saggers is used, as well as the "cones" for determining the temperature. Care must be taken with the temperature of the kiln during this process, as a sudden fall causes the ware to "blib," or show a wavy or lumpy appearance on the surface.

The total time required to complete the process of enameling is 36 hours. For 22 hours a "low heat" is required, followed by 14 hours of "high heat," a temperature of 2100 degrees F. being required during the "high heat" period. The oil consumption is about 60 barrels.

Common brick require from 35 to 50 gallons of crude oil per thousand bricks burned and about 5 days are necessary to water smoke and burn. The consumption of oil varies somewhat with the analysis of clay and percentage of water. The table below gives typical analyses of common brick clays:

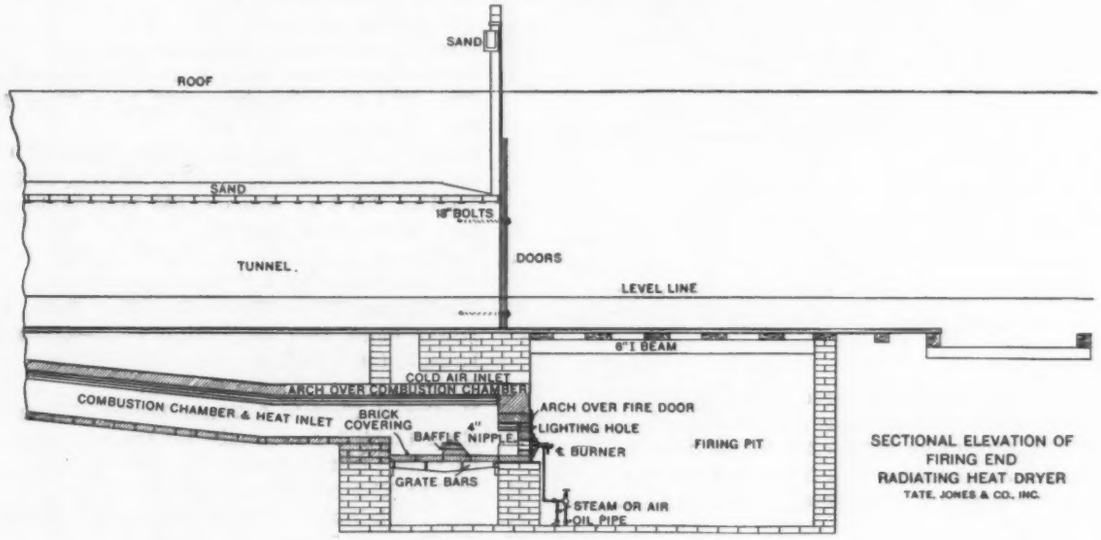


Fig. 49. Gloss Kiln.

Chemical Analysis of Common Brick Clays.

	Average. Per cent.	Minimum. Per cent.	Maximum Per cent.
Silica (SiO_2) combined.....	15.0	12.0	30.0
Silicia sand	55.0	20.0	60.0
Alumina ($A_{12}O_3$)	14.0	11.0	25.0
Water (H_2O), combined.....	4.0	3.0	9.0
Water moisture	2.0	0.0	6.0
Iron oxide (Fe_2O_3)	4.0	2.5	8.0
Lime (CaO)	1.5	0.5	7.0
Magnesia (MgO)	1.5	0.3	7.0
Alkalies (K_2O, Na_2O)	3.5	2.0	7.0

In order to determine the length of time, the amount of fuel, and the air required for burning brick, one of the largest manufacturers of oil burning equipment has gathered the following data:

The oil for burning brick varies with different clays from 20 to 80 gallons per thousand brick—an average being 50 gallons per thousand. The burning of most clay wares can be divided into three periods, namely:

First—The drying out or water smoking period, requiring from 1 to 4 days of 24 hours each, with an average of 2½ days. During this period from 10 to 30 per cent of the gross amount of fuel required is burned, the average being 15 per cent.

Second—The period during which the temperature is raised from that of the water smoking period to the extreme

temperature necessary to burn the ware, requiring from 2½ to 6½ days of 24 hours each, with an average of 4½ days. During this period from 45 to 75 per cent of the gross amount of fuel is required, the average being 65 per cent.

Third—The oxidization period, during which the maximum temperature is maintained, in order to thoroughly burn or vitrfy the product. This varies from ½ to 2½ days, with an average of 1½ days, about 20 per cent of the gross amount of oil being burned.

The process of burning fire brick is similar to that of common brick, except that longer time, higher temperature, and much more oil is required. The average time being from 7 to 8 days, and the oil consumption per 1000 bricks varying from 120 to 140 gallons.

Air Required for Atomizing.

With oil burners only 8 cu. ft. of air or steam per lb. of oil is required for atomizing when the furnace shows a draught of ⅛ in. to ⅜ in. of water in a U glass. The amount of air required for atomizing is thus determined by the amount of oil burned during the second period, for during this period more oil is burned per burner per minute than during any other. Computations for a typical kiln are given below:

Assuming a kiln of 120,000 capacity:

First Period:

Total time—2½ days = 60 hours = 3600 minutes.

Total brick in kiln—120 M. divided between 10 burners, or 12 M. to each burner.

Total oil required per M. brick, 50 gallons.

During the 1st period, 15 per cent or 7.5 gal. = 56.25 lb. × 12 (M. brick) = 675 lb. of oil, divided by 3600 minutes = .1878 lb. per minute.

Air required for atomizing 8 cu. ft. per lb. of oil, or 8 × ,1875, or 1.5 cu. ft. per minute × 10 burners or 15 cu. ft. per minute.

Second Period:

Total time—4½ days = 108 hours = 6480 minutes.

During the second period 65 per cent or 32.5 gal. = 243.75 × 12 = 2925 lb., divided by 6480 = .451 lb. per minute.

Air required for atomizing 8 cu. ft per lb. of oil or 8 × .451 = 3.40 cu. ft. per minute × 10 burners, or 34 cu. ft. per minute.

Third Period:

Total time—1½ days or 36 hours = 2160 minutes.

During the third period 20 per cent or 10 gal. = 75 lbs. × 12 = 900 lb., divided by 6480 = .412 lb. per minute. Air required for atomization 8 cu. ft. per lb. of oil, or 8 × 4.12 = 32.96 cu. ft. per minute.

Since the kiln selected above burned 120,000 bricks in 7½ days, or 16,000 bricks per day, the amount of air required for a similar kiln of any given capacity may be easily computed. Thus, for a kiln with a capacity of 30,000 bricks per day, a compressor capable of furnishing 65 cu. ft. of free air per minute is required. The most favorable working pressure for kilns is 20 lbs. per sq. in.

The "thermophone" is an instrument which has recently been perfected by M. de Lange for use as a telephone receiver. It consists of a fine loop of platinum wire mounted in a metallic case having a small orifice, the whole being contained in a small ebonite tube to be inserted in the ear. It is operated by variations in temperature set up in the loop by the telephonic currents, the decrease or increase in the heat of the wire cooling or heating the surrounding air which causes audible vibrations.

WASHINGTON HYDROELECTRIC POWER PLANTS.

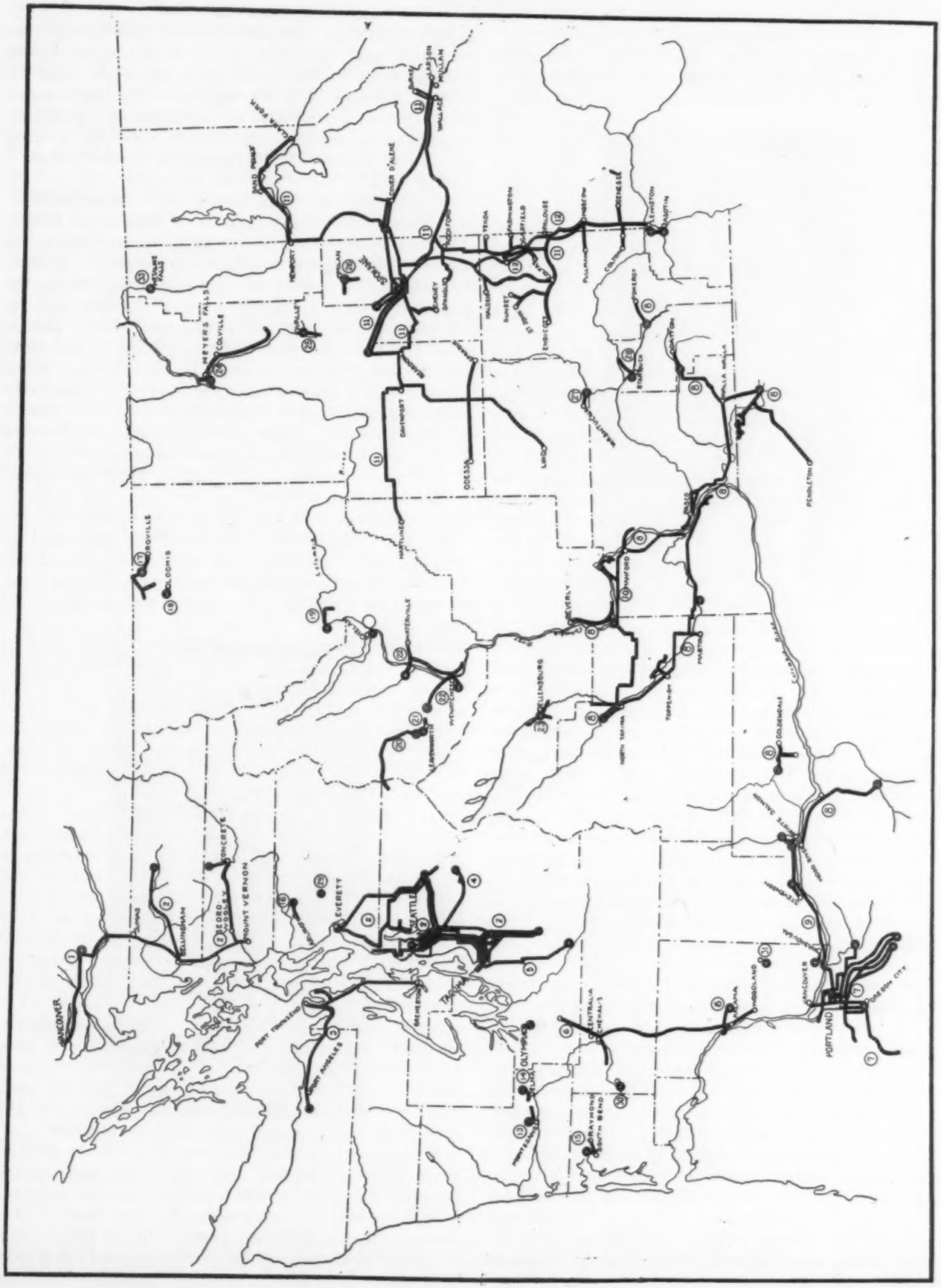
The accompanying map shows the hydroelectric power developments and transmission lines in the State of Washington. This map has been adapted from that compiled by the engineering department of the Public Service Commission of Washington.

The water power developments of the public service companies shown, exclusive of those in British Columbia and Oregon, total over 180,000 kw. for privately owned plants, and 31,750 kw. for municipally owned. In addition to this hydroelectric power there is, of course, a large amount of steam power developed.

Detailed statement of capacity and a key to the map follows:

1. Western Canada Power Co.—17,500 kw.
2. Puget Sound Traction, Light and Power Co.—Electron, 14,000 kw.; Snoqualmie, 18,000 kw.; Nooksack, 1500 kw.; White River, 20,000 kw.
3. Olympic Power Co.—4800 kw.
4. City of Seattle—10,800 kw.
5. City of Tacoma—20,000 kw.
6. Washington-Oregon Corporation—675 kw.
7. Portland, Railway, Light & Power Corporation—Oregon City, 7230 kw.; Cazadero, 9900 kw.; River Mill, 14,250 kw.; Hood River, 9000 kw.
8. Pacific Power & Light Co.—Walla Walla, 2750 kw.; Dayton, 200 kw.; Pomeroy, 150 kw.; Natches, 6000 kw.; North Yakima, 300 kw.; Prosser, 600 kw.; White Salmon, 75 kw.; White River, 2250 kw.
9. Northwestern Electric Co.—12,000 kw.
10. Hanford Irrigation & Power Co.—1800 kw.
11. Washington Water Power Co.—Post Falls, 11,250 kw.; Lower Falls, 8800 kw.; Little Falls, 22,000 kw.; Long Lake, 55,600 k.v.a.
12. Spokane Inland Empire Railway.
13. Northwest Electric & Water Works—30 kw.
14. Elma Light & Power Co.—120 kw.
    Olympia Light & Power Co.—1000 kw.
15. Willipa Electric Co.—115 kw.
16. Jim Creek Water, Light & Power Co.—200 kw.
17. Similkameen Power Co.—350 kw.
18. Tillicum Development Co.—450 kw.
19. Okanogan Valley Power Co.—220 kw.
0. Chelan Electric Co.—75 kw.
20. Great Northern Railway—6500 kw.
21. Tumwater Light & Power Co.—200 kw.
22. Wenatchee Valley Gas & Electric Co.—2680 kw.
23. City of Ellensburg—950 kw.
24. Stevens County Power & Light Co.—336 kw.
25. Kulzer Electric Light and Power System—45 kw.
26. Little Spokane Light & Power Co.—80 kw.
27. Washtucna Electric Co.—540 kw.
28. Starbuck Electric Co.—100 kw.
29. Granite Falls Electric Co.—60 kw.
30. Central Power Co.—60 kw.
31. North Clark County Light & Power Co.—60 kw.
33. Inland Portland Cement Co.—2830 kw.
    Superior Portland Cement Co., Concrete—1320 kw.

In addition, at Asotin and Lewiston, Idaho, across the Snake River from Clarkston, Wash., are hydroelectric plants of 400 and 1500 kw. respectively. At Republic, Wash., southeast of Loomis (No. 18 on map), the Republic Light & Power Co. has 125 h.p. supplementary steam and gas power and the North Washington Power & Reduction Co. has 750 h.p. in water wheels. At Stevenson the Skamania Light & Power Co. generates 75 kw. hydroelectric power.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FARMINGTON
ELBERTON
ROSALIA
COLFAX
PALOUSE
GARFIELD

INSIDE WIRING METHODS

By JOHN CARRELL

Introduction.

The purpose of these articles is to review the present methods used in electrical construction and, to some extent, the systems of estimating employed therein. It is not the writer's intention to adopt the role of efficiency expert nor yet to stimulate the sense of humor of electrical contractors by discovering a new method of estimating. Sufficient unto the trade are the methods in vogue.

Much has been said recently about the electrical business being profitless; that the business is sick and needs a physician. Many long discourses have been published concerning the science of efficient management; elaborate charts for guidance of estimators have been formulated; fallacies in computation of profits have been exposed; in fact every symptom of a disordered business, and the remedies therefor, have been in some way touched upon. That the electrical contracting business is somewhat indisposed is correct and the condition has existed so long that doubt exists whether there are sufficient funds in the fraternity strong box to pay for a competent physician even if one could be discovered. But though indisposed, much hard work has given the business a strong constitution and the most probable remedy is the application of a fair degree of practical common sense.

To find some one who has time, inclination and ability to prepare a simple, accurate, comprehensive and uniform system of estimating is a problem. A successful financier might write a reliable book on the art of finance, but it would not pay. An expert estimator might write a useful book on estimating electrical installations, but he is kept too busy. However, every successful contractor has a systematic way of computing quantities of material and labor with a fair degree of accuracy and it is scarcely believable that a business man cannot be trusted to add the proper percentage for overhead and profit. The trouble must, at least in part be found somewhere else.

When the supply of electrical contractors about equals the demand for their services, electrical equipments will be installed for about cost and may include a fair return to the contractors for their efforts. When the supply of contractors greatly exceeds the demand for service something worse usually happens and it sometimes happens in this way. From ten to twenty estimators descend upon the affable and alert architect or general contractor, each possessed with the firm determination to do a certain piece of work cheaper than his rivals. Each takes off the many items comprising the quantities and makes a good bet on the speed of his workmen. The greater number of estimators arrive at the lowest possible cost of installation. One or more fail to effectually apply the squeezing process or want a fair return for their effort and their bids are hopelessly high. But one poor fellow squeezes so hard that he forgets to include some of the items. He is the fortunate bidder! The fortunate bidder can usually muster a legion of reasons to explain his figures.

When contractors take work, whether because of error or design, at a price below the cost of installation, they will at least do minimum requirement jobs and will most probably do so called skinned jobs because they are compelled by necessity to keep the cost of the work as nearly as possible to the contract price. Owners or architects who give work to a contractor whose bid is exceptionally below the average are almost sure to be disappointed in the execution of the work.

Ninety per cent of the trouble with the entire building trade is the giving of work to the lowest bidder. That the system is unfair to all concerned and is responsible in a great measure for defective building is obvious. A remedy for this condition, though the suggestion may belong to a more altruistic age, is the giving of the work to the average bidder. That is to add the amount of all bids and divide by the number of bids, the one nearest to the average to be accepted. To protect all concerned from purposely high or purposely low bids those which are a certain percent above or below average should be dropped and a new average taken from the remainder.

The voice of the quantity surveyor has been heard in the land, but has not been heeded. The quantity survey method is to have quantities of material and labor surveyed by an institution, the personnel of which would consist of expert estimators taken direct from the field. Separate estimate sheets for each job would be compiled by different men and compared and checked by others. The accuracy of the completed sheets should be guaranteed. These sheets could be furnished to contractors at a cost below that of maintaining separate estimators and to others interested at reduced prices after contracts are let. The method would be a safe guard against serious error and would effectively establish an institutional price for work. Material men who do a large credit business should also see another advantage.

Estimating is by far the most vital work of the contractors' organization. The personnel should comprise men of rare judgment, with well remembered or systematically recorded experience, with an accurate knowledge of the fine points of construction and of material; and all this in addition to accuracy and quickness with figures, knowledge of current prices, etc. The method used to compute quantities is of secondary importance so long as accuracy, directness and simplicity are the principal features. The accurate counting of material is of course of great importance; the correct approximation of labor is even more essential. The first may be reduced to utmost precision; the second cannot be more than an intelligent guess. The system which is based upon the division of the proposed labor into the smallest practical units and upon comparison with similar units of work actually executed will show the best results. By practical units is meant such as may be deducted from information contained in the time cards of the journeyman and material sheets from the stock room.

After proper quantities of material and labor have been compiled comes the question of overhead expense and profit. That some strange psycho-pathological phenomena has manifested itself among electrical con-

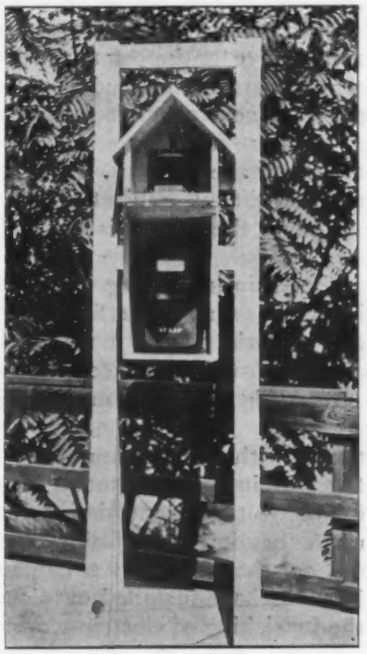
tractors, centered upon these important items, is evident from the printed data on the subjects which have been circulated broadcast of late. The principal point which the authors of this data strive to make clear is that if the percentage for overhead is based on gross receipts, then the same percentage based upon net costs would show a smaller amount. Example: Gross receipts, 100; net cost, 60; overhead, 20; 20 is 20 per cent of 100, but 33 1-3 per cent of 60.

Another point emphasized is that while estimated profits may vary with conditions of the work or with circumstances of the contractor or customer and while actual profits may be larger than expected or be wiped out entirely, still the overhead expenses go on and on forever. That delusions exist concerning these points are vouched for by well balanced, logically minded men. It might be well if overhead expense could be added to the cost of each item of labor and material before they reached the estimate sheet though, of course, the net price sheet is the practical basis of working; but the man who intentionally omits the proper allowance for overhead expense would be better off in charge of a tool bag; for then he would be reasonably sure to receive a certain fixed compensation for his work.

(To be continued.)

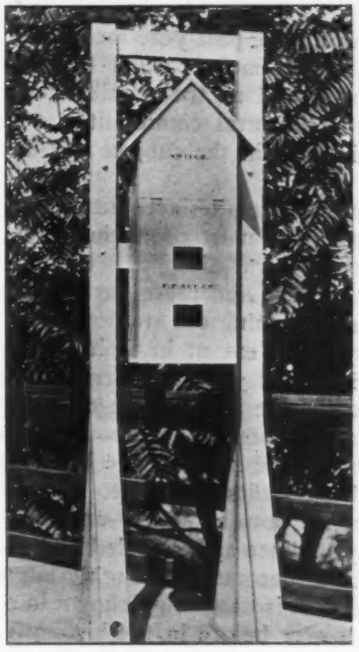
RURAL METER BOXES.

A recent Bulletin of the Pacfic Power & Lght Company gives an interesting description of an excellent plan for protecting meters installed for irrigation consumers which has been devised by B. C. Bailey, manager for the company at The Dalles. Throughout The Dalles district most of the irrigation is done in small units and in most cases the ranchers do not care to go to the expense of putting up a pump house, and at best just throw together a few boards to cover the installation. Consequently, in order to protect the instruments, a meter box was designed. These boxes are installed for all irrigation customers.



Inside View, Showing Switch and Meter.

The upper part of the box, marked "Switch," contains the switch and fuse blocks, the cover being hinged. Between this upper compartment and the lower one, which contains the meter, is a tight wooden shelf or partition which separates one from the other.



Outside View, Showing Window for Meter Reading.

The cover on the meter compartment is provided with two holes which are fitted with glass in order that the meter can both be read and the disc seen without removing the cover. This cover, instead of having hinges, is securely fastened on by screws, as the customer has no occasion to get at it, and the only time that the cover need be taken off is when the meter man wishes to test or change the meter in some way.

These boxes are all painted standard pearl gray and are sufficiently large to contain the regular Type D-3 meter used in polyphase work. The boxes can be placed on the pump house, if such is provided, but otherwise they are mounted on substantial poles, or on a rack, as shown in the picture.

Electric shock, when fatal, usually destroys the coagubility of the blood. Blood rarely clots when death is caused by an electric current. Yet the anatomical injury from most cases of electric shock is so slight that if physiological activity of the heart and the central nervous system can be restored, life will be continued.

Chemical sterilization of water may be satisfactorily accomplished by ozone, calcium hypochlorite, or gaseous chlorine. Ozone has had wide development in Europe, but mechanical imperfections and the high cost of operation have delayed its adoption in this country. The chlorine process is covered by patents but the "bleaching powder" process may be applied by anyone having the requisite knowledge of its action.

ELECTRICITY IN RURAL DISTRICTS.

BY J. L. WHITE.

(Excellent suggestions are here made as to means whereby the central stations can increase the use of electric current in rural districts. This paper was presented at the Commonwealth Conference at Eugene, Ore., by Mr. White, who is manager for the Oregon Power Company at Eugene.—The Editor.)

The subject "Electricity in Rural Districts" is one that has been discussed considerably during recent years, but during the past year more than ever before it has been given more careful consideration as a serious problem and as the possibilities and uses of electric service in rural communities become generally known interest in the subject will be more widespread.

The Eastern states on account of their density of population offer the most promising field for exploiting electricity in rural districts. The farmers of the Pacific Coast states, and more particularly the states of Oregon and Washington, are not as yet using electricity to any great extent in their work, although a wide use of it is being made for irrigation purposes.

At present there are a great number of gasoline engines in use throughout the country for pumping water, and successful results have been obtained with them; and these outfits are not to be generally belittled, but electric power should—and will—supersede these entirely as lines are extended and the reliability of electric power becomes thoroughly known.

More interest is now being shown in scientific agriculture than ever before in the history of the country. One has but to read the papers to know the progress that is being made. The establishments of farmers' co-operative associations, institutes and granges, and the establishment of experimental stations, all tend to simplify the problem by educating the farmer to the use of modern methods.

It is commonly known that the farmer is of the "show me" class, and therefore, must be convinced of the economical and practical value of electricity in performing his work before he will spend any great amount of money for its adoption.

The practical value of electric service to the farmer includes not only a saving of his time, but also a reduction in the amount of hired help he needs. There are many and varied ways in which the farmer can use electric service, a few of which are in operating:

Pumps for water supply,	Hay hoists,
Fanning mills,	Hay balers
Ensilage cutters,	Clover hullers
Wood saws,	Spraying machines
Concrete mixers,	Cream separators,
Grain threshers,	Milking machines.

In addition to these uses of electricity the farmer may have at his command, any of those appliances which are commonly used in the city, such as the electric flatiron, washer, vacuum cleaner, sewing machine motor, etc. These appliances appeal especially to the housewife.

The possibilities for the use of electric power on the farm in the arid regions are greater than any other. The first use mentioned above to which the electric power can be put to on the farm is, I believe, the most important of all, that is in pumping water for domestic purposes. The statistics gathered by the United States go to show that the chief drawback in farm life—especially for the housewife—is the lack of running water and modern sanitary conveniences, which drawback is eliminated by having power, which takes the place of the city main, and as such sanitary conveniences are installed, so will the general health of a district be improved, to say nothing of the lessening of the household burdens.

Electricity is the most flexible form of energy known and when the farmer bceomes to realize this fact he will use enough energy to warrant supplying it to him.

Although I have so far in this paper dwelt on the uses to which electricity can be put to on the farm there are other industries in rural districts besides farming which can use electric power to advantage. Among these are:

Sand and gravel plants,	Institutional schools,
Stone quarries,	Creameries,
Brick and tile works,	Dairies.
Railway pumping plants,	

I appreciate that all communities do not have all of these industries but each community may have some of them and this business combined with the business to be obtained from the farmers should in most cases justify an extension of lines.

It is a fact that it will not pay to make long and costly transmission line extensions solely for the purpose of serving a scattered farm load, although it is equally true that a farming load will pay as a by-product when such extensions already exist or are being made to take care of other classes of business. Before a great many years the country will be covered by a network of transmission and distribution lines reaching out from a central point to small communities, and incidentally furnishing power for many other purposes along the way.

The somewhat difficult subject of how to extend such service to serve the farmer is the greatest problem at present.

There are conditions existing right under power companies' lines that, owing to the fixed charges necessary to provide electric power, make it difficult and in some cases almost impossible for the power companies to meet in competition with gasoline or distillate.

The company with which I am connected is now operating altogether in the Willamette Valley eighty-five miles of high voltage transmission lines. These serve a district extending from Dallas, on the north, to Springfield, on the south. At numerous places along these lines we have installed out-door type substations for the furnishing of electric service to groups of farmers for power and lighting purposes.

The problem of obtaining the heavy capital investment necessary to serve farm business may be met in any one of several ways. In some communities the farmers have financed local distribution systems of considerable size, taking energy from a cross-country transmission line and retailing it among themselves. In other places farmers have paid the whole or a part of the cost of erecting the distribution circuit. In still other instances the companies require

a yearly minimum guaranteed income which is commensurate with the cost of the necessary extension.

The proposition of getting farmers to erect and maintain their own line extensions is one which depends on local conditions. There is some question among a great many companies as to the advisability of allowing other parties to erect and maintain lines attached to their transmission and distribution systems because of the fact that the construction and maintenance of such foreign lines are often not equal in quality to that of the lines of the company. It is often hard to control the work on such lines and they sometimes become a hazard to the service.

One of the most general schemes is for the company to extend its lines to customers on a guaranteed income of such amount that the cost of the line will be returned to the company in from one to three years; some companies requiring that the income shall be equivalent to the cost of the line in one year and others in three years. Another plan that some companies have used in supplying rural business is to require that the customer contribute a certain portion of the investment which is returned to him should he be able at some future time to interest some of the other farmers along the extension.

In certain European countries, where service from transmission lines is available, co-operative electric supply undertakings have been formed and are working satisfactorily. These co-operative distribution companies buy energy from the central station company and transform it in privately owned substations for rural distribution. In planning a co-operative system the promoters canvass the surrounding country to ascertain the attitude of their neighbors toward such a scheme and also the possible light and motor load that can be expected. By this means the size of the substation is determined. It has been the practice to apportion the stock among the consumers according to their connected loads. Usually the necessary capital is furnished by a banker, each copartner giving a note for his share of the capital. In the European countries the interest in the more advanced use of electricity is growing rapidly, largely on account of the scarcity of farm help.

As a result of the attention that has been given to the subject of rural distribution during the last two years a great advance has been made in the design of equipment to cheapen such work so that the investment necessary to serve the rural business can be held to the lowest possible amount, commensurate with good service and safety of lines. Out-door substations have been developed by several companies and the larger manufacturing companies are working at present on the design of various types of these stations, ranging all the way from simple transformer installations with the necessary protective apparatus to substations of some magnitude having automatic regulators for voltage control.

I might say in conclusion that it has been demonstrated time and again that the electric method of doing things tends for greater efficiency. Starting with water power converted to electric power we can go on producing forever any mechanical operation. We can re-fertilize our lands, cultivate them, harvest and transport the crops to market, cook our meals, light and heat our homes, etc., and do it efficiently.

The great problem of all ages has always been to connect the producer and the consumer. If we could produce, distribute, and consume all other products as efficiently and as simply as we can electricity, this great loss between production and consumption would be reduced eighty to ninety per cent.

THE DIFFICULTIES OF WATER POWER DEVELOPMENT.

BY S. B. HUSTON.

(The following remaks on the need of better legislation to encourage the development of water power which must compete with other forms of power is taken from an address before the Commonwealth Conference at Eugene, Ore. While they were made with particular reference to the proposed plan of hydroelectric districts in Oregon, they are pertinent in their application to all water power development in the West.—The Editor.)

There is a popular idea that electricity developed from water is a very cheap and inexpensive power; that the profits to be derived from a plant of this kind are far in excess of the profits from a plant operated by steam power. I had this opinion myself until I made some investigation of the matter.

This opinion is so firmly fixed in the mind of the public that it will be a difficult thing to convince it to the contrary, and the chances are that some of you will not agree with me in this because of your preconceived notions on the subject. The fact is, however that there are many conditions and circumstances under which power developed by steam can successfully meet and underbid power generated by hydroelectric plants.

The reason for the popular impression lies in the fact that the cost of operation of the hydroelectric plant seems to be so much less and this is the feature by which it most readily appeals to our observation. A careful investigation, however, soon discloses that the competition between steam power and water power is very close indeed. A mill or factory using power must be located with a view to the disposition of its product. It must be accessible to shipping points and terminal facilities.

The plant for the generation of steam power can be located where the mill or factory is situated, but the water power plant must be located where the water power is. It results, therefore, that in most cases the water power plant is located at a considerable distance from the mill or factory using the power. Therefore, a large amount of capital is invested in the transmission line. We usually think that the capital is invested in the dam and the power house, but in a majority of cases, according to the testimony of the most eminent engineers of this country, more than 50 per cent of the capital is invested in transmission lines radiating from the plant and the substations at the ends of the transmission lines for the conversion and distribution of the transmitted power to the premises of the various consumers.

To build a hydroelectric plant costs from two to four times as much as a steam plant, and often, even then, the hydroelectric plant will not pay as much dividends on the amount invested as the steam plant, and the steam plant is likely to be preferred because

it can be erected for so much less capital. Furthermore, steam power is a better power than hydroelectric power because it gives a more steady pressure and is less likely to interruption.

The amount of water power developed depends upon the amount of water in the stream, and that depends upon climatic conditions, which vary in different years and in different seasons of the same year. For this reason hydroelectric power must be produced at a cost which will allow it to be sold for a little less than steam power. Unless more favorable legislation can be secured from Congress than anything that has been enacted so far, plants will not be a success financially, and the water power of this country will go undeveloped except in the most favorable localities.

It goes without saying that a municipality or a district ought not to invest money in enterprises that private capital is afraid of because whatever may be said in favor of municipal ownership, it will not be contended that the municipality can own and operate these plants cheaper than can be done by private capital; therefore, if the present laws are so framed as to deter private capital from investment, it should equally deter municipalities from a like investment.

What then, is the situation? It has already been pointed out to you there is scarcely any water power that can be developed at the present time without the use of public lands or of water in unnavigable streams. All of the public lands useful in water power development have been withdrawn from entry under the existing laws and under the statutes permitting the use of land within the various reserves and the use of waters in unnavigable streams, the tenure is uncertain.

A county or municipality desiring to make a development requiring the use of lands within the National reserve must first file, under the state law, upon the water of the stream which is to be developed. It must then apply to the Federal Government for the right to use the Government lands involved, submitting with the application all the necessary plans, data, etc., called for by the Department of Agriculture.

Under the present law the county or municipality may then, upon the payment of a certain sum of money after complying with certain regulations, obtain a permit to go ahead with the work. What is the nature of this permit and what rights does the company really acquire under it? It obtains a right which is revocable at will, unassignable and therefore unmortgageable, subject to interference from mining claims and which becomes void whenever any change is made in the situation of the lands either by transfer from the jurisdiction of one department to another or by the granting of the right of entry.

There has recently passed the lower house of Congress an act relating to these matters that is much more favorable than the existing law, and yet it is doubtful whether this law is sufficiently liberal to attract capital for the development of water power. This act in substance gives the Secretary of the Interior, under certain limitations, authority to lease any of the public lands except National parks and military reserves for a period not longer than 50 years.

A person or company desiring to procure a lease of this kind must first apply to the Secretary of the Interior for a permit to go upon the lands for the purpose of securing the necessary data to enable him to determine whether or not it is a valuable water power for the purpose of development.

Then there must be a finding by the chief officers of the department under whose supervision such lands fall, that a lease will not injure, destroy or be inconsistent with the purpose for which such reserve was created.

The lease is to provide that the lessee shall not at any time contract for the delivery to any one consumer of electrical energy in excess of 50 per cent of the total output. If such power is transmitted into more than one state or is in a territory, the regulation and control of service and charges for service and the issuance of stocks and bonds is conferred upon the Secretary of the Interior, and two or more plants may be combined physically under the permission of the Secretary of the Interior, but no agreement must be made to fix or increase prices for electrical energy; that no sale or delivery of power shall be made to a distributing agent except in case of an emergency unless with the written consent of the Secretary of the Interior, and these leases are not assignable without such consent. No mortgage or trust deed may be executed without such consent.

The government may take over any such plant by giving three years' notice immediately prior to the expiration of the lease by paying the actual cost of the right of way and the structures and fixtures acquired or erected upon the lands, but such valuation shall not include the value of the franchise or good will of profits to be earned on pending contracts.

If the United States does not take over the plant, a new lease may be executed to the lessee or to a new lessee under such terms as may be agreed upon. The bill further provides, and this is the most critical feature of it in my judgment, that the Secretary of the Interior has authority to specify in the lease and to collect charges or rental for all power developed, sold or used by the lessee, and the money shall go into the reclamation fund, and when it is returned to such fund, 50 per cent to go to the state within whose boundaries the plant is located.

It will thus be seen that the rental charge is wholly within the discretion of the Secretary of the Interior. A broad-minded, liberal man in that position, who knew the West and its conditions, and was interested in seeing its water power developed would naturally be disposed to make the rental charge very low and thus encourage the development of hydroelectric power. If the man occupying that position happened to be a different type of man or if it happened that the Pinchots of the country thought there was political capital to be made by attacking a Secretary of the Interior who was disposed to be friendly to the West, then the charges might easily be so high as to absolutely prohibit the development of hydroelectric power.

You will see, therefore, why I have taken pains to point out to you some of the disadvantages under which hydroelectric power development rests. If hydroelectric power could be developed at a much less cost than steam power, then the amount of tax to be placed upon the power development by the Secre-

tary of the Interior would not be important, but since the competition is so close a tax may make the difference between success and failure. This will be more especially true with reference to the plant to be constructed in these hydroelectric districts, because they will necessarily be small plants, and for that reason cannot produce electrical energy as cheaply as a larger plant.

There is no other business that I know of in which there is so much more economy in a large plant than in a small one. There is another feature of this bill in this connection which is also important. That is the length of the lease. This act provides for a lease for not more than 50 years. The Secretary of the Interior might arbitrarily say that he would not make a lease for more than five or ten years. There is a great prejudice in the public mind at the present time against long term franchises or leases. If the Secretary of the Interior was inclined to be liberal in this respect there might go up a cry for political effect or otherwise against the Secretary of the Administration of which he was a member. A weak man might yield to this and refuse to make leases for longer than ten years.

Anyone who knows anything about the subject at all would readily understand that neither private capital nor a municipal corporation can afford to invest the amount of money necessary for the development of hydroelectric power with only a ten year lease and no assurance that it will ever be renewed. It is true that this bill authorizes the Secretary of the Interior to renew the lease, but the Secretary is absolute dictator as to the terms and restrictions to be placed in the lease.

The act authorizes him to place any restrictions in the lease that he sees fit provided they are not contrary to the express terms of the act. The individual or corporation, municipality or otherwise, with his or its money tied up in the plant would not be upon equal terms with the Secretary in the negotiations for a lease. An arbitrary man in that office (and arbitrary men do sometimes hold that office) could simply say, "There are my terms. Take them or let them alone," and the lessee would have about as much chance to make a fair bargain as would the single individual who undertakes to bargain with a large industrial corporation for the wages which he shall receive as a common laborer.

If there were a provision in this bill that the lessee should have the first right upon the expiration of the lease, and that if the Secretary and the lessee could not agree upon the rental charges, then it should be submitted to arbitration by a board composed of high-class hydroelectrical engineers or that it might be fixed by a court after due hearing, then it would give a little more stability to the character of the investment. The whole matter is left to the arbitrary discretion of the Secretary of the Interior. Ordinarily people will not invest money in an enterprise which is subject to the arbitrary decree of any single individual regardless of the high station which he may hold.

It may be asked, as it often has been asked, what authority has the Federal Government to fix charges upon water which is wholly within the boundaries of a state and not in a navigable stream? Legally it has no power at all.

Such water does not belong to the Federal Government and is not under its control. It passed out of the control of the Federal Government when the State of Oregon was admitted to the Union. How, then, does it undertake to do this? In this way: There is a large amount of land, the title of which remains in the Federal Government. It is true that the government is simply a trustee for the people in this respect to convey this land to private individuals, but latterly a new theory has sprung up, namely, that the government will not part with the title to this land but will retain it for the benefit of the whole people, and since it owns the land it can refuse to allow anyone to erect a power plant or a dam, or any of the necessary fixtures for the development of waterpower unless the lessee will agree in the lease to a rate of charges or tax to be paid to the government for the privileges acquired by the lease.

There is no doubt in my mind that the government can do this. Whether or not it ought to do it is a different question. It does not seem fair to the people of the West. The Eastern states have utilized their water power to the limit almost, without any such tax or charge being placed upon its development.

P. P. I. E. NOTES.

The illumination features of the Panama-Pacific Exposition at San Francisco have been subjected to an exhaustive series of tests which demonstrate their effectiveness and beauty.

The exhibit of the Western Union Telegraph Company will cover 2000 square feet, and consists of a magnificent booth containing apparatus for demonstrating how the corporation's mighty system is operated; also mural illustrations of what could not be comprehensively shown in more practical form. How messages are relayed around the world will be one of the mysteries revealed to the layman by the Western Union.

The American Tel. & Tel. Company will display a great curved map of the United States showing the development of telephone and telegraph service. This will be supplemented by a complete historical exhibit of telephone improvements, including demonstrations of long-distance telephoning between New York and San Francisco.

Three hundred and fifty high pressure gas lamps have recently been set in position along the North Driveway at the Panama-Pacific International Exposition by the Pacific Gas & Electric Company. They are to be the main source of light here, and will be extensively utilized for lighting in the Zone, and in the States and Foreign Area. A novelty in illumination is introduced in the lighting of the Court of Abundance, where gas flambeaux will alternate with electrics.

A persistent rumor is being circulated in the Northwest to the effect that the opening of the Exposition will be postponed until March 15, 1915. This rumor is absolutely unfounded on fact, and exhibitors may rest assured that the gates will open on February 20, 1915, next, without fail.

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San Diego's Exposition

The new year witnesses the opening of the earliest of California's two great expositions which are expected to divert the world's travel to the Pacific Coast during 1915, that at San Diego, in the extreme southwestern corner of the United States, close to the Mexican border. San Diego is the "first port of call" north of the Panama Canal, and the gateway to a great territory whose agricultural development is of vital importance to the nation.

Agricultural development is consequently the predominant feature at this beautiful exposition. Not lifeless piles of farm products, but working illustrations of the processes will be shown the visitor. Manufacturers will show not what they make, but how they make it; fruit may be seen growing on the trees, and the ideal conditions of farm life are illustrated by a model farm, completely equipped with the latest electrical labor-saving devices.

The San Diego exposition differs not only in purpose, but also in appearance. Wide-spread buildings set amid lawns and groves of shrubbery transport one to the romance of Spanish cathedral, palace and mission, all amid the climatic advantage and scenic beauties of Southern California.

The diversified functions of electricity at this exposition are told elsewhere in this issue. But to be appreciated they should be seen. And so San Diego invites the world to inspect her tremendous opportunities.

This exposition is not in opposition to the Panama-Pacific International Exposition at San Francisco, but supplements it, and typifies the life of the great southwest in the same manner that the great exposition typifies the progress of the world.

Municipal Ownership Misgivings

To the close student of public utility affairs on the Pacific Coast there are several signs which might indicate that the crest of the wave of popular sentiment in favor of municipal ownership of public utilities has been reached. This reactionary feeling is not confined to any one locality, but seems to be general up and down the Coast.

At Seattle public confidence in municipal ownership has been weakened by the deficit of nearly $6000 a month which has accrued in the operation of electric railways, by Mayor Gill's veto of the bill extending the municipal lighting system beyond the city limits, and by the leaks at Cedar Lake, which make the new $1,500,000 Cedar River dam almost useless.

At San Francisco the municipal street railways have been a success. Many factors have contributed to this outcome, not the least being the strategic position of the Geary street and Van Ness avenue lines, which tap the most populous sections of the city, and have natural attractions at terminal points—the sea beach, Golden Gate Park, the exposition and the fer-

ries. The administration has been sane and conservative, though this is no guarantee as to future political conditions.

The first stumbling block which has appeared in the San Francisco situation is the matter of expensive and unprofitable extensions, as is exemplified by the controversy over the Church street line. Bion J. Arnold, in his comprehensive report on the traction situation, suggested that this service be provided by a tunnel, as the grades along this street between Eighteenth and Twenty-second streets are too heavy for trolley operation. The bonds for the municipal railways, totaling $3,500,000 were intended to cover the cost of track and overhead construction, but did not include the cost of necessary grading or tunnel work. When plans were drawn for this extension the city engineer suggested that the additional expense involved be borne by district assessment. Vigorous objection was raised to this plan by the district affected, whereas other districts objected to a general assessment for the benefit of a particular district.

San Francisco has the distinction of having more district improvement clubs than any other city of its size in America, there being 275 of these. This is largely due to the natural topographic features which divide the city into a large number of heights and valleys. More or less jealousy exists between these several districts and prevents any effective action for the improvement of one section at the expense of the others. This local jealousy is stronger than any united sentiment for municipal ownership, and is probably strong enough to defeat future bond issues for extensions of utilities as costly as electric railways.

This is a most unfortunate situation, as the present franchise requirements are so stringent as to effectually deter any private corporation from undertaking to supply needed traction extensions. The most feasible solution would be the enactment of a charter amendment which would allow indeterminate franchises. Such an amendment had been framed by Mr. Arnold, but was defeated because its advantages were not understood by the public.

At Los Angeles a similar feeling will retard the consummation of the plan to distribute aqueduct power in the city. The city is now endeavoring to acquire the distribution lines of the Southern California Edison Company, which serve only a part of the city area. Localities which are not reached by these lines naturally object to being taxed for the supposed benefit of the places which will be served. Furthermore, when the public fully realizes how little good the city is getting from the aqueduct water there is likely to be a complete revulsion of popular opinion.

There are other examples of municipal ownership where political methods have not been allowed to interfere with efficient operation. Tacoma, Alameda and Pasadena do not yet seem to have been affected, and smaller towns are making a showing equally as good.

However, when the public comes to weigh the advantages and disadvantages of private versus governmental operation, when they consider the benefits of public service commission control over all public utilities, and when they think of the need for private capital to develop the resources of the Western territory, it is believed that they will ultimately encourage private capital in the public service.

A Nose For News

Electrical men sometimes complain that their efforts are not fully appreciated by the public they serve. While electricity has created most of the comforts and conveniences of modern civilization, those who supply current are often the subject of much adverse criticism. This ill-will is biased, being based upon ignorance, and the real responsibility for its continuance rests upon those who are being criticized and neglect to state their side of the case, thereby losing by default.

The average American takes his opinions from the newspaper. Yet, in proportion to its importance, how little information about electricity and its applications is published in the daily papers. There is no subject about which so much "news" can be written. New inventions, new uses, and spectacular applications for electricity are found every day and can be made the subject of interesting articles. The reason that such news does not get into the big dailies oftener is that the reporters lack the technical knowledge to write about it intelligently. Rather than display their ignorance they omit all reference to electricity.

The reporters are as anxious to get news for their papers as the central station men are to get new consumers. The central station man with enough imagination to see the news possibilities of his business and with enough interest to write it for publication can get all the publicity he wants. He can make clear the difficulties that are met in giving satisfactory service by a newsy story about the troubles caused by last night's wind-storm. He can obviate many a complaint about high bills in winter by a timely story about how electric lights lengthen the shortest day in the year. New generating machinery or new service extensions are always good copy. To many people it would be news to learn how it is possible to get light, heat, cold and power from the same wire. There is no industry which has such news possibilities as the electrical, and there is none where this golden opportunity is so neglected.

So every central station official should cultivate "a nose for news," which is merely applied imagination, so as to gain the friendship of the reporter who will then make friends with the people for the company. But should his enmity be secured, even by an ungracious audience, he has it in his power to create more enemies for the company in a day than can be won by a year of unadvertised good service.

PERSONALS

C. L. Cory, consulting electrical engineer at San Francisco, is at Denver.

F. N. Averill, manager of the Fobes Supply Company of Portland, is at Francisco.

J. A. Hunt, electrical contractor of Pleasanton, Cal., was a visitor at San Francisco during the week.

J. Petty, of the Central States Electric Company, Fresno, spent a few days during the week at San Francisco.

M. C. Martin of the Martin Electric Fixture Company, Tacoma, Wash., is spending the holidays in Kansas City.

John Shady has been elected president of the Malta Light Company, which is now supplying current for Malta, Montana.

John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, has returned to San Francisco from the East.

B. A. Hansen, representative of the A. G. Electric Company, San Francisco, returned the first part of the week from a business trip to the south.

F. D. Weber, electrical inspector for the Underwriters' Bureau at Portland, is at Eureka, Cal., where he was called by the serious illness of his father.

A. G. Wishon, general manager of the San Joaquin Light & Power Corporation of Fresno, Cal., is visiting his daughter and son-in-law at Salt Lake City, Utah.

F. S. Hurst, of Pierson, Roeding & Co., San Francisco, is on a trip to Southern California, and is expected to return the first part of the coming week.

W. S. Heger Jr., of the Busch-Sulzer Diesel Engine Company, San Francisco, returned to the city after an extended business trip to Los Angeles and the southern part of the State.

W. S. Hanbridge, secretary of the California State Electrical Contractors' Association, with headquarters at San Francisco, returned during the week, after a trip through the southern territory.

W. E. Johnson, resident salesman of the Westinghouse Electric & Manufacturing Company, Fresno, is a visitor at San Francisco, where he expects to remain until after the year-end holiday season.

W. A. Kraner, consulting and contracting engineer, has returned to Portland after inspecting the system of the Snow Mountain Power Company in California for whom he is to undertake some new construction work.

C. E. Groesbeck has been appointed vice-president and general manager of the Utah Power & Light Company with headquarters at Salt Lake as successor to P. B. Sawyer, who has resigned. Mr. Groesbeck has been connected with the Electric Bond & Share Company for some time past and prior to that was about eight years in the organization of H. M. Byllesby & Company principally in their Pacific Coast properties. He has spent the last two months in Salt Lake City familiarizing himself with the organization and operation of the company preparatory to assuming the duties of this important position.

H. Thurston Owens, until recently secretary and general manager of the San Diego (Cal.) Gas & Electric Appliance Company, has become associated with the Lighting Fixture house of Bayley & Sons, with headquarters at 101 Park avenue, New York City. Mr. Owens has been in the lighting business for fifteen years with the Consolidated Gas Company, the city of New York, the American Gas Light Journal, and general manager of the La Crosse (Wis.) Gas & Electric Company. He has been actively identified with the work of a number of gas and electric associations and a frequent contributor to the trade papers.

Paul B. Sawyer has resigned as vice-president and general manager of the Utah Power & Light Company of Salt Lake City. Mr. Sawyer has held the position as general manager of this company since its organization a little over two years when the Electric Bond & Share Company acquired the control of all the electrical interests in the state of Utah outside of Salt Lake City and Ogden, and parts of southern Idaho and merged them to form the Utah Power & Light Company. The task of welding together fifteen or twenty separate and dissimilar properties with their great differences in operating conditions, and commercial policies and rates, has devolved largely upon Mr. Sawyer and the results secured considering the business and financial conditions which have obtained during this period are a strong testimonial is to his forcefulness and ability. He resigns to accept a position in the organization of Mr. Harrison Williams of New York City with offices at 60 Broadway. Prior to his connection with the Utah Power & Light Company Mr. Sawyer was general manager of the Des Moines Electric Company.

MEETING NOTICES.

Oregon Society of Engineers.

At a meeting of the Council of the Illuminating Engineer-Engineers on January 14, 1915, Mr. E. A. West, efficiency engineer for the Portland Railway, Light & Power Company, will present a paper on mechanical tabulating machines.

Utah Electric Club.

The regular luncheon of the Utah Electric Club at the Commercial Club on Thursday, December 24th was given over to a high jinks. A musical program was furnished by the Fred C. Graham Lyceum Bureau, consisting of popular songs in which the members joined. Mr. Hy Dunbar, the popular comedian of the line and service department of the Utah Light & Traction Company furnished one of his characteristic monologues containing numerous hits and take-offs on local electrical celebrities.

The Jovian Electric League of Southern California.

The well-attended luncheon of the League on December 23rd was permeated with a holiday spirit, from the holly decorations to the snappers at each plate, provided through the thoughtfulness of "Doc" C. D. Lamoree, the chairman of the day, who was himself presented with a box of violets from some of his Long Beach friends. C. H. Carter made un unsuccessful attempt to tell in three minutes all he knew or could find out about Dean George A. Damon, and H. C. McCutchan walked in on crutches, badly battered, and for good reasons refused to give even a three-second talk on R. J. McHugh. Miss Florence Miller entertained the crowd with a number of brilliant pianologues, and then James Dervin gave some amusing ventriloquistic stories. A splendid talk, or rather "Some Shocks," were then delivered by Robert B. Armstrong, a well-known real estate operator, whose optimistic utterances were appropriate and helpful. He told the boys why he was glad that he lived in the United States, in California and in Los Angeles. He firmly believes that conditions are steadily improving, illustrating his point by a reply to the question: "How far does a dog go into the woods?" to the effect that the dog goes in half way, for after that he is coming out. "Bad times are now half way in."

Illuminating Engineering Society.

At a meeing of the Council of the Illuminating Engineering Society held December 10, 1914, an extensive report of the status of illuminating engineering education in the colleges of this country was received from the Committee on Education. The report included (1) a summary showing

the extent of instruction in laboratory work in illuminating engineering at thirty-nine colleges; (2) a complete curriculum for a four year undergraduate course leading to an illuminating engineering degree; (3) a one year undergraduate adjunct course; (4) a one year post graduate course, (5) a classified list of books in English, pertaining to illuminating engineering. The report is to be printed for distribution later.

The following resolution was received from the Committee on Nomenclature and Standards:

Resolved, that it is the opinion of this committee:

(a) That the output of all illuminants should be expressed in lumens;

(b) That illuminants should be rated upon a lumen basis instead of a candle power basis;

(c) That the specific output of electric lamps should be stated in lumens per watt and the specific output of illuminants dependent upon combustion should be stated in lumens per British thermal unit per hour.

The Exhibition Booth Committee (Electric) submitted a report giving the conditions under which the Society's series of booths, which were designed to present in an attractive way the fundamental principles of good lighting, may be obtained for display in show rooms of central station companies, at conventions, expositions, etc.

Electrical Development and Jovian League.

Big plans have been made to have 1915 the banner year for the Electrical Development and Jovian League of San Francisco. President F. H. Leggett has taken active charge and announces a number of innovations which are expected to liven things up a bit. First among these is the appointment of a chairman of the day, who will preside and be responsible for the speaker and entertainment at each meeting. It is hoped to have a weekly attendance of 200 members by making the meetings so attractive that no electrical man can afford to stay away. Hereafter the meetings will be held on Wednesday noon.

The first meeting of the new year will be held at the Hof Brau, Pacific Building, 12:15 p. m., January 6th. Mr. Geo. C. Holberton will be chairman of the day and will introduce Mr. Geo. Drake Smith, who will talk about "Selling Electricity by the Mile," and will start something new in the electrical development of San Francisco. A musical program will also be presented by talented artists. At the meeting of January 13th, Mr. C. F. Butte will be chairman of the day.

President Leggett has announced the appointment of the following committees:

Entertainment.
E. M. Cutting
A. H. Halloran
S. V. Walton

Membership.
W. L. Berry
G. I. Kinney
A. E. Drendell

Ways and Means.
T. E. Bibbins
W. H. Seaver
P. C. Butte

Finance.
C. C. Hillis
R. M. Alvord
A. E. Rowe

Grievance.
W. S. Hanbridge
S. W. Gilman
C. E. Wiggin

Legislative.
W. W. Briggs
R. F. Oakes
W. L. Goodwin

Relations With Society for Electrical Development.
C. E. Heise
H. V. Carter
J. A. Vandegrift

Live Wire.
A. H. Halloran
T. E. Collins
F. H. Poss
D. E. Harris
Hal Lauritzen

NEW CATALOGUE

A booklet entitled "The New Line of Cutler-Hammer Magnetic Switches" has just been printed for distribution by The Cutler Hammer Manufacturing Company of Milwaukee. This new line of switches as described in this booklet includes the new magnetic lock-out switch of the series coil operated type, the redesigned line of shunt coil operated switches, and spring closed switches for dynamic brake service.

CALIFORNIA ASSOCIATION OF ELECTRICAL INSPECTORS

Section of N. A. E. I.

C. W. Mitchell, President. Arthur Kempston.
Wm. G. Pennycook, Vice-Pres. B. C. Hill, Executive Comm.
John W. Carrell, Secretary-Treasurer, 814 Scott, San Francisco.

The purpose of this organization is to standardize the common practice in electrical construction with the National Code as the general standard.

Questions pertaining to electrical construction will be answered in these columns, but only from the point of view of the Code. This is a voluntary organization and the answers published under this heading must not be construed as authoritative, or binding. No attempt will be made to correllate the answer from the several Inspection Districts, as an occasional difference of opinion will tend to induce further study on subjects. All questions will be passed upon by an executive committee.

Address all communications to the secretary.

By the Secretary.

Inspectors often encounter difficulty in determining sizes of wire on completed installations, especially where large conductors are soldered into lugs secured to terminals, as in back of switchboards. Some men claim to be expert in approximating sizes by merely glancing at the insulated wire; but most of us are failures in this respect. If guessing cannot be avoided it should be done in the most methodical way possible. Secure a pair of calipers, preferably made of insulating material and small enough to be carried in vest pocket, a rule, graduated in sixty-fourths of an inch and a table of over-all diameters of wire. The following table gives average diameters over insulation of stranded, rubber covered, double braid wire in sixty-fourths:

No. B. & S. Gauge.	Diam. in Inches.	Circular Mils.	Diam. in Inches.
8	21/64	250,000	56/64
6	26/64	300,000	60/64
4	29/64	350,000	63/64
3	31/64	400,000	1 2/64
2	33/64	450,000	1 5/64
1	38/64	500,000	1 9/64
0	41/64	600,000	1 17/64
00	44/64	750,000	1 22/64
000	48/64	1,000,000	1 32/64
0000	52/64	1,250,000	1 43/64
		1,500,000	1 51/64
		2,000,000	2 4/64

NEWS OF IDAHO PUBLIC UTILITY COMMISSION.

The commission has submitted a report to the Governor through its president, J. A. Blomquist, giving a report of its expenditures during the past two years and its recommendations for appropriations for the next biennial. It has been in operation 19 months and their expenses for this period has been as follows:

Salaries of three commissioners	$18,566.60
Clerks and other employes	12,017.79
Office furniture and fixtures	1,482.98
Supplies and expenses	869.72
Stationery, printing and postage	3,377.11
Traveling expenses of commissioners and employes.	1,486.26
Estimated expenditures for the month of December..	3,514.99
Total to January 1st	$41,315.45

The last legislature appropriated $60,000 for the expenses of the commission so that there will be nearly $19,000 of this appropriation unexpended at the end of the biennial period. For the next two years the budget submitted by the commission is as follows:

Salaries	$43,200.00
Furniture and fixtures	200.00
Freight, express, telephone and telegraph bills	400.00
Printing and postage	4,550.00
Traveling expenses	3,600.00
Miscellaneous and contingencies	3,250.00
Total	$55,200.00

The commission also recommends an increase in the present corps by the addition of a chief engineer at a salary of $6,000 a year, an assistant engineer, $4000 a year, and a rate clerk at a salary of $4800 a year with traveling expenses for this additional force of $3000, making a total additional expense of $19,800. The total estimated requirements of the commission for the next two years with this increase in

force if granted by the legislature will be approximately $75,000.

In discussing these innovations President Blomquist says: "We recommend that an appropriation be made for the purpose of enabling this commission to maintain an engineering corps and a rate department. This is absolutely necessary so that the commission may properly perform the functions which the law intended it should. In the matter of fixing rates, the commission has been, up to this time, and will be in the future unless an appropriation is made, unable to make any investigation as to the values of the properties of the utility companies, which is necessary to fix proper and just rates."

It is also suggested that the legislature take some action extending the powers of the commission and allowing it to control the issue of stocks and bonds by public utility corporations. Mr. Blomquist says in regard to this matter: "We particularly recommend that the public utilities law of this state be amended and enlarged so that the commission will have control and supervision of indebtedness of public corporations.

"This, in the judgment of the commission, is necessary for two reasons: First, to protect the public from overcapitalization and encumbering the plant of the utility corporation. Second, to protect the investors in such stocks and bonds of the company and thus place the stamp of approval upon such issue of stocks or bonds by some public authority.

"A similar law is now in effect in 15 states of the Union, so that the plan has been fully tested and is thoroughly approved. In addition to this however, the law should be fully amended so as to give the commission detailed supervision of the disposition of proceeds so realized from the sale of such stock or the issue of such bonds. It would be almost useless to give the commission authority over the issue of stocks and bonds unless it was also given some control over the expenditure of such money and to see that it was applied for the purpose for which it was intended."

Practically all the books and records of the Washington Water Power Company were thrown open to the attorneys, accountants and engineers of the Federal Mining & Smelting Company of Coeur d'Alene by the order of the public utilities commission issued December 19. Unsuccessful in a similar application some months ago, the mining company took the matter to the courts and obtained there a decision, which, though it refused to alter or annul the order of the public utilities commission, was worded in such a way that the commission considered it an instruction to give the mining company practically free reign for its investigation. Accordingly when the matter was again brought to the attention of the commission, the power company was instructed to furnish certain named books and any others which contain references to the mining company. The investigation is for the purpose of securing evidence that the power rates furnished to the Federal Mining Company are unjust and unreasonable. It is expected that the power company will attempt to secure the nullification of the order through the courts.

The public utilities commission is investigating the rates charged by the Washington Water Power Company in the northern part of Idaho. The commission, upon complaint of the power users, put into effect in November a schedule of rates which should be in effect in the towns of St. Maries, Genesee, Troy, and Moscow until the case could be heard by the commission. Power at these four cities is furnished by companies which are owned by the Washington Water Power Company; the Idaho-Washington Water Power Company, and the St. Maries Light & Power Company. In their answer these companies set forth that not only were their rates low enough but that, in many cases, they were too low and asked that the commission make a full and complete investigation. Much of the testimony introduced was of a technical nature. An agreement was reached on the rates to be charged in Moscow by which the schedule which the commission suggested, with some slight modifications, will be adopted by the company. In the other cases, the company pleaded high cost of service on account of the small population and the fact that the houses were scattered over a comparatively large area. Captain E. G. Davis appeared for the state and John P. Gray of Coeur d'Alene and M. C. Osborn of Spokane, rate man for the power company, presented the case for the defendants.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The commission has issued a supplemental order authorizing the Midland Counties Public Service Corporation to renew two notes held by the United States Aluminum Company in the sum of $78,000 at a rate of interest not to exceed 7 per cent per annum. The company was previously given permission to renew notes at 6 per cent per annum.

Fresno Interurban Railway Company has filed an application with the commission renewing its request for authority to issue 200 shares of capital stock at $80 per share and $14,700 of 10 year 6 per cent bonds at not less than 90. The company was recently authorized to issue 100 shares of capital stock at not less than $80 per share in lieu of 100 shares of stock issued for incorporation purposes at $10 per share. The company contends that it has not the authority to release the 100 shares of old stock issued for incorporation purposes, it having been mutually understood by the subscribers that these shares would be held by the company solely for voting purposes.

The Southern Counties Gas Company of California has filed an application with the commission requesting authority to issue $54,869.64 of promissory notes to be secured by the pledge of its 3 year gold notes. The company states that owing to financial conditions, it finds it impossible to sell any of its gold notes at the present time. The company has also filed an application requesting authority to renew promissory notes now outstanding in the sum of $66,007.89.

The commission has rendered a decision authorizing the San Joaquin Light & Power Corporation to renew certain promissory notes aggregating $92,500.

The commission has rendered a decision authorizing the Midland Counties Public Service Corporation to renew promissory notes aggregating $24,795.67.

The commission has rendered a decision authorizing the Selma Water Works, Madera Water Works, Madera Light & Power Company, Lemoore Light & Power Corporation and Bakersfield Gas & Electric Company to transfer all their property, both real and personal, to the San Joaquin Light & Power Corporation. In consideration for this transfer, the San Joaquin Light & Power Corporation is to cancel all of the capital stock of the above-mentioned companies with the exception of the Bakersfield Gas & Electric Company. This latter company has an outstanding bond issue and it is proposed to cancel all of its stock with the exception of sufficient shares to qualify directors.

The San Diego Consolidated Gas & Electric Company has filed an application with the commission requesting authority to renew 3 promissory notes totaling $55,000, in favor of H. M. Byllesby & Company.

The commission has rendered a decision authorizing the Rodeo Land & Water Company to sell its water, gas and electric systems to the Beverly Hills Utilities Company of Los Angeles. The latter company is authorized to issue 100 shares of capital stock of the par value of $100 per share to be issued in payment for the properties.

The commission has rendered a decision authorizing the Western States Gas & Electric Company to issue $101,000 of its 5 per cent bonds at not less than 82½ and accrued interest. These bonds are to be issued in lieu of $142,700 of 3 year notes previously authorized by the commission.

The commission has rendered a decision authorizing the Central California Gas Company to issue $8000 of first mortgage 6 per cent bonds at not less than 90.

The commission has issued a supplemental order authorizing the Central California Gas Company to issue $10,000 of 6 per cent bonds and $1000 of common stock. The company was previously authorized to issue $15,000 of bonds and $10,000 of stock, but later requested that the amounts be reduced.

The commission has issued an order authorizing the San Francisco-Oakland Terminal Railways to issue $246,666.66 of promissory notes to be secured by an issue of $370,000 of general lien bonds. The commission in its opinion states that it has given its authorization for this temporary financing in order that the company may be preserved in the best possible operating condition.

The commission has issued an order granting the City Electric Company of San Francisco an extension of time to and including June 30, 1915, to sell $833,000 of its first mortgage 5 per cent 30 year sinking fund gold bonds.

The commission has issued a supplemental order at the request of the Western States Gas & Electric Company canceling authority previously granted for the issue of $142,700 of three year 6 per cent notes. In lieu of these notes, the company proposes to issue $101,000 of its 5 per cent bonds.

The commission has issued a supplemental order authorizing the Great Western Power Company to renew a note in favor of the Old Colony Trust Company of Boston in the sum of $150,000. This note is secured by a pledge of $225,000 of first montgage 5 per cent sinking fund 40 year gold bonds.

TRADE NOTES.

The Tahoe Electric Water Company has leased large quarters at 775-779 Towne street, Los Angeles, where a complete plant for the electric purification of water will be installed.

Evans-Dickson Company, consulting electrical engineers and contractors, Tacoma, Wash., are doing the electrical work in the Howe Building and putting in a switchboard for the Lincoln High School, Tacoma.

The Rupert Electrical Company of Rupert, Idaho, is in the market for 50 to 75 air heaters and a switchboard capable of handling 200 amperes at 220 volts complete with switches and fuses. F. N. Victor is president of the company.

The Byron Jackson Iron Works of Los Angeles have secured an order from the Yuma Electric and Water Company for one special pumping unit, consisting of two 1800-gallon pumps, each working under a 125 ft. head, split type, direct-connected, on the same base, to a 150 h.p. General Electric motor, by means of a double shaft extension. The outfit pumps water out of the Colorado River for domestic supply of Yuma, Ariz.

The Salt Lake Electric Supply Company has secured the contract for the electric lighting fixtures for the Newhouse Hotel which is nearing completion and will be ready for occupancy about February 1 of next year. This is one of the largest electric fixture contracts ever secured by a local manufacturer and all of the fixtures to be used in the building will be made up in Salt Lake City. A number of the major rooms, including the main dining room, the ball room, main entrance, vestibule, and lobby will be executed along strict period lines, the architect having designed the electric fixtures to conform to the decorations of the room. J. L. Fugate represented the Salt Lake Electric Supply Company in the deal.

The Pacific Coast Coal Company has entered into a contract with the Puget Sound Traction, Light & Power Company for electric current and will operate its entire Burnett Mines by electric power generated at the Stone & Webster White River plant. The contract for the entire electrical equipment has been placed with the Allis-Chalmers Manufacturing Company, through its Seattle sales office. This equipment will include a motor generator set, about 1000 h.p. in motors and the necessary transformers and switchboards. Three of the motors will be direct-connected to multi-stage pumps and will be of the special high speed type manufactured by the Allis-Chalmers Manufacturing Company at their Bullock Works at Cincinnati, Ohio. One 200 h.p. motor at 1800 r.p.m. synchronous speed will be direct connected to a Platt Iron Works multi-stage pump. One 125 h.p. motor at the same speed will be direct-connected to an Alberger turbine pump and a 50 h.p. motor will supply the power for operating the DeLaval centrifugal pump. The motor geerator set will be designed to furnish direct current at 560 volts for operating various d.c. motors about the mines. The equipment was designed by Mr. N. D. Moore, acting chief engineer of the Pacific Coast Coal Company.

PROGRAMME OF THE NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE U. S., CONVENTION, SAN FRANCISCO, CAL., July 18, 19, 20, 21, 22, 23, 24, 1915.

Sunday, July 18—

Arrival of special train at San Francisco, 9:55 A. M.

Convention headquarters, Clift Hotel, corner Geary and Taylor street.

Convention meeting place, the Auditorium, Market, Hayes and Larkin streets.

Monday, July 19—

Sight-seeing.

Tuesday, July 20—

10:00 A. M.—Meeting of directors and executive committee.

Wednesday, July 21—

10:00 A. M.—Open session.

Address of welcome, President of the San Francisco Association.

Address of Mr. John R. Galloway, president of the National Electrical Contractors' Association.

Address of the Hon. James Rolph, Jr., Mayor of San Francisco.

Illustrated address, Mr. John Britton, manager Pacific Gas & Electric Company.

Address, Mr. Charles C. Moore, director general of the Panama-Pacific International Exposition.

Address, Mr. W. L. Goodwin, sales manager, Pacific States Electric Company.

2:30 P. M.—Business session.

Evening—Reception and dance at Clift Hotel, 9 P. M.

Thursday, July 22.

10:00 A. M.—Business session at Auditorium, Market, Hayes and Larkin streets.

2:00 P. M.—Automobile ride for ladies and guests through Golden Gate Park and Presidio.

2:30 P. M.—Business session, Auditorium.

Evening—N. E. C. A. night at the "Zone," Exposition grounds.

Friday, July 23—

10:00 A. M.—Final business session at Auditorium.

2:30 P. M.—Board of directors at Clift Hotel.

3:30 P. M.—Executive committee at Clift Hotel.

7:00 P. M.—Dinner, dance and vaudeville at Pompeian Court, Hale building, Fifth and Market streets.

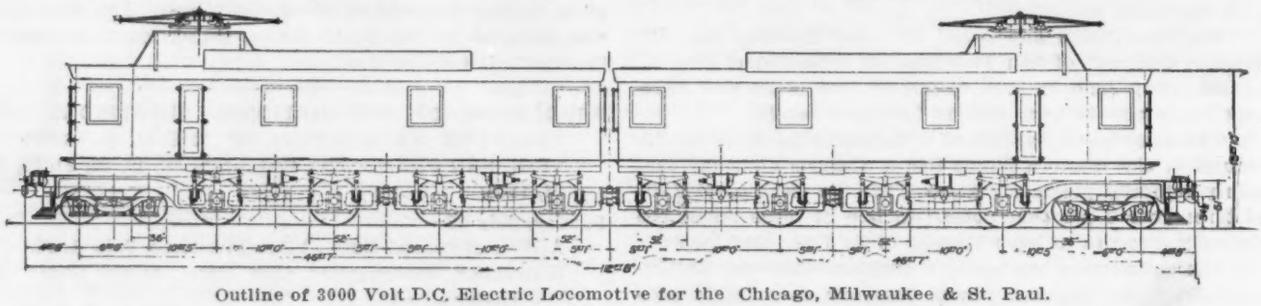
Saturday, July 24—

9:00 A. M.—Trip by special steamer around San Francisco Bay, and through the Golden Gate, landing at Exposition grounds early in the afternoon. Luncheon to be served on board.

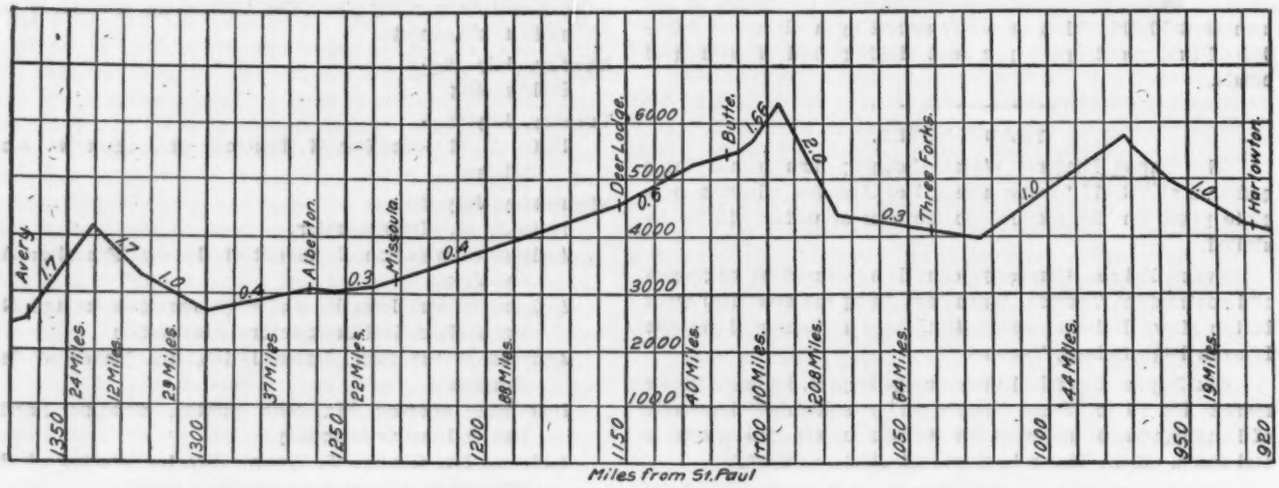
INDUSTRIAL

ELECTRIFICATION OF THE PUGET SOUND LINES OF THE CHICAGO, MILWAUKEE & ST. PAUL RAILWAY.

Plans for the electrification of the first engine division of the Chicago, Milwaukee & St. Paul Railway have now been completed and contracts let to the General Electric Company for the electric locomotives, substation apparatus and line material, and to the Montana Power Company for the construction of the transmission and trolley lines. This initial electrification of 113 miles of main line between Three Forks and Deer Lodge is the first step toward the electrification of four engine divisions extending from Harlowton, Montana, to Avery Idaho a total distance of approximately 440 miles, aggregating about 650 miles of track including yards and sidings. While this comprises the extent of track to be equipped in the near future it is understood that plans are being made to extend the electrification from Harlowton to the coast, a distance of 850 miles, should the operating results of the initial installation prove as satisfactory as anticipated.



Outline of 3000 Volt D.C. Electric Locomotive for the Chicago, Milwaukee & St. Paul.



Profile of the Present and Proposed Electrified Divisions of the Chicago, Milwaukee & St. Paul.

The plans of the Chicago, Milwaukee & St. Paul Railway are of especial interest, as this is the first attempt to install and operate electric locomotives on tracks extending over several engine divisions, under which conditions it is claimed the full advantage of electrification can be secured. The various terminal and tunnel installations have been made necessary, more or less, by reason of local conditions; but the electrification of this road is undertaken purely on economic grounds with the expectation that superior operating results with electric locomotives will effect a sufficient reduction in the present cost of steam operation to return an attractive percentage on the large investment required.

The first step taken toward electrification by the Chicago, Milwaukee & St. Paul Railway was to enter into a contract with the Montana Power Company for an adequate supply of power over the 440 miles of main line considered for immediate electrification. The precautions taken both by the railway company and power company to safeguard the continuity of power supply should guarantee a reliable source of power subject to few interruptions of a momentary nature only.

The Montana Power Company covers a great part of Montana and part of Idaho with its network of transmission lines, which are fed from a number of sources, of which the principal ones are tabulated below:

Madison River	11,000 kw.
Canyon Ferry	7,500 kw.
Hauser Lake	14,000 kw.
Big Hole	3,000 kw.
Butte, steam turbine	5,000 kw.
Rainbow Falls	21,000 kw.
Small powers aggregating	7,390 kw.
Total power developed	68,890 kw.

Further developments, part of which are under construction, are as follows:

Great Falls	85,000 kw.
Holter	30,000 kw.
Thompson Falls	30,000 kw.
Snake River	20,000 kw.
Missoula River	10,000 kw.
Total	175,000 kw.
Total power capacity developed and undeveloped	244,000 kw.

The several power sites are interconnected by transmission lines, supported on wooden poles and operating at 50,000 volts for the earlier installations, and on steel towers, and operating at 100,000 volts, for later installations.

Due to the great facilities available and the low cost of construction under the favorable conditions existing, the railway company will purchase power at a contract rate of $0.00536 per kilowatt-hour based on a 60 per cent load factor. It is expected under these conditions that the cost of power for locomotives will be considerably less than is now ex-

pended for coal. The contract beween the railway and power companies provides that the total electrification between Harlowton and Avery comprising four engine divisions, will be in operation January 1, 1918.

Freight Train Ascending Ruling Two Per Cent Grade Between Piedmont and Donald on Chicago, Milwaukee & St. Paul.

The immediate electrification of 113 miles will include four substations containing step-down transformers and motor generator sets with necessary controlling switchboard apparatus to convert 100,000-volt, 60-cycle, three-phase power to

Ore Train on the Electrified Butte, Anaconda & Pacific at Silver Bow, Crossing the Tracks of the Northern Pacific and the Chicago, Milwaukee & St. Paul.

3000 volts direct current. This is the first direct-current installation using such a high potential as 3000 volts, and this system was adopted in preference to all others after a careful investigation extending over two years. The 2400-volt direct-

Great Falls, Mont., on the Missouri River, at the Site of the New 60,000 Kw. Hydroelectric Development, one of the Plants That Will Supply Part of the Power for the Chicago, Milwaukee & St. Paul Electrified Division.

current installation of the Butte, Anaconda & Pacific Railway in the immediate territory of the proposed Chicago, Milwaukee & St. Paul electrification has furnished an excellent demonstration of high-voltage, direct-current locomotive operation during the past year and a half, and the selection of 3000 volts direct current for the Chicago, Milwaukee & St. Paul was due in a large measure to the entirely satisfatcory performance of the Butte, Anaconda & Pacific installation.

The substation sites of the Chicago, Milwaukee & St. Paul electrified zone provide for an average intervening distance of approximately 35 miles, notwithstanding that the first installation embraces 20.8 miles of 2 per cent grade westbound and 10.4 miles of 1.66 per cent grade eastbound over the main range of the Rocky Mountains. With this extreme distance between substations and considering the heavy traffic and small amount of feeder copper to be installed, it becomes apparent that such a high potential as 3000 volts direct current permits of a minimum investment in substation apparatus and considerable latitude as to location sites.

The location and equipment of the several substations is as follows:

Station.	Miles from Deer Lodge.	No. of Units.	Kw. per Unit.	Total.
Morel	17.1	2	2000	4000
Janey	50.5	3	1500	4500
Piedmont	77.9	3	1500	4500
Eustis	120.6	2	2000	4000

The trolley construction will be of the catenary type, in which a 4/0 trolley wire is flexibly suspended from a steel catenary supported on wooden poles, the construction being bracket wherever track alignment will permit and cross-span on the sharper curves and in yards. Steel supports instead of wooden poles will be used in yards where the number of tracks to be spanned exceeds the possibilities of wooden pole construction. Poles for the first installation are already on the the ground and thirty miles of poles are set. Work in this direction will be pushed with all speed and will be completed in the summer of 1915, ready for operation in the fall cn the delivery of the first locomotives.

The locomotives to be manufactured by the General Electric Company are of especial interest for many reasons. They are the first locomotives to be constructed for railroad service with direct-current motors designed for so high a potential as 3000 volts. They will weigh approximately 260 tons and will have a continuous capacity greater than any steam or electric locomotive yet constructed. Perhaps the most interesting part of the equipment is the control, which is arranged to effect regenerative electric braking on down-grades. This feature as yet has never been accomplished with direct current motors on so large a scale. The general characteristics as proposed are tabulated below:

Total weight	260	tons.
Weight on drivers	200	tons.
Weight on each guiding truck	30	tons.
Number of driving axles	8	
Number of motors	8	
Number of guiding trucks	2	
Number of axles per guiding truck	2	
Total length of locomotive	112	feet.
Rigid wheelbase	10	feet.
Voltage of locomotive	3000	
Voltage per motor	1500	
H.P. rating 1 hour—each motor	430	
H.P. rating continuous—each motor	375	
H.P. rating 1 hour—complete locomotive	3440	
H.P. rating conitnuous—complete locomotive	3000	
Trailing load capacity, 2 per cent grade	1250	tons.
Trailing load capacity, 1 per cent grade	2500	tons.
Approximate speed at these loads and grades	16	m.p.h.

The Chicago, Milwaukee & St. Paul Railway, from Harlowton to the coast, crosses four mountain ranges: the Belt Mountains, at an elevation of 5768 ft.; the Rocky Mountains, at an elevation of 6350 ft.; the Bitter Root Mountains, at an elevation of 4200 ft., and the Cascade Mountains, at an elevation of 3010 ft. The first electrification between Three Forks and Deer Lodge calls for locomotive operation over 20.8 miles of 2 per cent grade between Piedmont and Donald at the crest of the main Rocky Mountain Divide, so that the locomotives will be fully tested out as to their capacity and general service performance in overcoming the natural obstacles of the first engine division.

NEWS NOTES

FINANCIAL.

LA MESA SPRINGS, CAL.—The city clerk will receive sealed bids up to January 8th for the unconditional purchase of water and fire bonds in the amount of $8,100.

SALEM, ORE.—The state tax commission of Oregon has filed a report showing that the value of public service companies in that state is $18,094,192.24 as compared to an assessed valuation of $192,117,694.58 for last year.

AZUSA, CAL.—A resolution has been passed by the trustees providing for the issuance of bonds of the city of Azusa in the sum of $35,000 for the purpose of acquiring certain properties for a municipal water system.

SAN DIEGO, CAL.—Bond brokers of San Francisco have bought $1,000,000 of San Diego water bonds issued to John D. Spreckels as part payment for the Southern California mountain water system, according to City Treasurer Don M. Stewart. The bonds bear 4½ per cent interest and mature $26,000 annually from January, 1916, to January, 1953, inclusive, and are part of the issue of $2,500,000 dated January 1, 1913.

INCORPORATIONS.

TACOMA, WASH.—Articles of incorporation have been filed for the Molander-Hawaiian Power Company, with a capital stock of $250,000, by Geo. C. Bratt, H. A. Franens and Samuel Cassimere.

POCATELLO, IDAHO.—The Gate City Electric Supply Company has been incorporated with a capital stock of $10,000 with Pocatello as the principal place of business. The incorporators are D. M. Griffin of Salt Lake, president; Claude I. Kugler, manager; V. G. Kugler and Wm. Edens. The company will engage in a general electric supply business.

FRESNO, CAL.—The San Joaquin Light & Power Company has filed amended articles of incorporation with the county clerk and will take over three subsidiary companies. Amended articles of incorporation were also filed by the Madera Water Works. The directors are A. G. Wishon, J. H. Newlin and W. E. Durfey, all of Fresno. Amended articles of incorporation were also filed for the Selma Water Works, with the same directors; and for the Lemoore Light & Power Company, with A. G. Wishon, E. B. Walthall and W. E. Durfey, directors.

ILLUMINATION.

ENTIAT, WASH.—Gray & Son have entered into a contract to furnish light for the town of Waterville, Wash.

LODI, CAL.—The property owners of seven blocks of West Pine street have been given permission to install electroliers.

PILOT ROCK, ORE.—Engineer H. Freuler of Walla Walla, Wash., estimates that a lighting plant would cost about $3800.

DOWNEY, IDAHO.—The council is contemplating installation of street lights here. It is planned to install lights on the principal corners.

RED BLUFF, CAL.—A petition for an electrolier lighting system for Main street has been taken under consideration by the city trustees.

LONG BEACH, CAL.—The board of public works has awarded the Lantz Electric Company the contract for installing ornamental lighting posts in East Seaside boulevard.

FRESNO, CAL.—A resolution of intention has been passed for the construction of an electrolier street lighting system here on portions of H, I, J, K, L, M, Tuolumne, Mariposa, Tulare, Kern and Inyo streets.

TACOMA, WASH.—An ordinance has been passed providing for the installation of a lighting system on Cliff avenue, consisting of metal standards with a single globe lamp on each. The estimated cost is $9921.

MEDFORD, ORE.—The Rogue River Public Service Corporation has submitted a proposition to the city council to furnish the city with electricity on a wholesale basis, the city to put up poles and distribute the current.

GOLD HILL, ORE.—Before February 1, 1915, three turbines of 400 h.p. each will be set in motion at the power house of the Rogue River Public Service Corporation here, increasing the present plant from 500 to 1600 h.p.

SANTA BARBARA, CAL.—The Santa Barbara Gas & Electric Company has been granted a franchise to construct and operate a gas distributing system along all public highways within certain territory in Santa Barbara county.

PORTLAND, ORE.—City Electrical Inspector Dunlap has recommended for passage by the city council an ordinance prohibiting property owners from doing electrical work on their premises unless the work is supervised by a reliable electrician.

SAN DIEGO, CAL.—The city council has authorized the installation of electric arches that are to illuminate Broadway from Atlantic to Twelfth and Fifth streets from L to Laurel, under the supervision of D. H. Christ of the city engineer's office, in charge of lighting.

LOS ANGELES, CAL.—The city council has declared its intention of ordering the installation and maintenance of an ornametal lighting system on Olive street between Sixth and Pico streets, and defining exterior boundaries of the district to be benefited by the improvement.

EL CAJON, CAL.—Only one bid for the contract for lighting the town was received, from the San Diego Consolidated Gas & Electric Company. As this bid was for 5 years, while the ordinance provides only for one year contract, it was referred to the city attorney for correction.

TACOMA, WASH.—Superintendent of Electrical Works Collins has been instructed by the council to bring in an estimate of replacing the pole line of the east side of Commerce street and the cost of putting the wires under ground. It is stated the line is in a dangerous condition and should be replaced at once.

SEATTLE, WASH.—The city utilities committee of the City Council has by unanimous vote recommended the light extension bill for passage over Mayor Hiram Gill's veto. The bill proposes to appropriate $10,000 to extend the municipal light and power system to Tukwila, Wash., Foster, Wash., and contiguous territory.

SALT LAKE CITY, UTAH.—The officers of the Utah Light & Traction Company and the city commission have reached an agreement with reference to the matter of consolidating the franchises of the Utah Light & Railway Company and the Merchants Light & Power Company, both of which have been acquired by the Utah Light & Traction Company. In consideration of the transfer of these franchise rights to the new company substantial reductions in rates are made to the citizens of Salt Lake City amounting to as much as 20 per cent in the case of certain customers, the minimum reduction being 10 per cent and the average about 12 per cent. Under the ordinance as passed by the city commissioners on December 21st, the company agreed to furnish the standard 4 ampere arc lamp at a price not to exceed $4.75 per lamp per month when fed from underground circuit and $4.50 per lamp per month when fed from overhead lines.

TRANSMISSION.

EVERETT, WASH.—A franchise to erect and maintain poles for a power line along the county roads running north from Arlington has been granted to the Jim Creek Water, Light & Power Company.

ESCONDIDO, CAL.—Sealed bids will be received by the board of supervisors of San Diego county up to February 3r, for a franchise to operate a system of transmission wires, and poles under and along public highways within township 10, for the Escondido Mutual Water Company. The franchise is to extend over a period of 50 years.

SEATTLE, WASH.—The city council has directed the mayor and comptroller, through the legal department to make immediate application to the government for power permits on the Sauk and Siuatle rivers in the Washington and Snoqualmie National Forests, having in mind the possible development of a municipal power site in these two watersheds.

TRANSPORTATION.

SAN FRANCISCO, CAL.—A charter amendment to have the people vote on the expenditure of all earnings of municipal street railways has been submitted to the supervisors.

LEWISTON, IDAHO.—The council has granted a franchise to the Nortz syndicate of Minneapolis for the operation of street cars in Lewiston, R. C. Dahikjelm representing the syndicate.

PRESTON, IDAHO.—The Ogden, Logan & Idaho Electric road will extend its lines to Preston and erect a brick depot. The estimated cost is $200,000. It is to be in operation by March 1st.

SEATTLE, WASH.—The public utilities committee of the Municipal League has made a report to the parent body that the Seattle, Renton & Southern Railway is not worth to exceed $900,000 as compared to $1,500,000 which is being asked the city for it.

SEATTLE, WASH.—The state public service commission of Washington is demanding "adequate and comfortable" street car service in Seattle on the part of the Puget Sound Traction, Light & Power Company. Sweeping changes are being asked in the schedule.

NORTH YAKIMA, WASH.—The Yakima Valley Transportation Company is gathering data and preparing plans for the extension of the lines of the company into Cowiche valley and to Tieton postoffice. The plans are for the construction of the extension as soon as the money market will enable it to secure funds.

STOCKTON, CAL.—The Central California Traction Company and the Stockton Electric Railway Company are about to enter an agreement by which the traction company will lease to the railroad company certain street railroad lines in this city. The agreement also provides for the abandonment of certain lines and the cancellation of the rate of fare of 24 rides for $1, previously in effect upon the lines of the traction company.

SAN FRANCISCO, CAL.—In accordance with the instructions of the supervisors, City Engineer O'Shaughnessy is preparing plans and specifications for the construction of the Church street municipal railway line as far as the available money will carry it. The understanding now is that the proposition of creating an assessment district to pay for opening a new street over the hill may be dropped, and that only the city's bond fund will be drawn on for building the road. In this event it can be constructed as far as Twenty-second street, O'Shaughnessy says. The original plan was to build it to Thirtieth street.

FRESNO, CAL.—J. B. Rogers has agreed to change the routing of the Fresno Interurban Railroad to the southeastern city limits from K to L streets, the city trustees instructed the city engineer to draw up an ordinance providing for the widening of Valeria street north of McKenzie avenue, between curbs, to 46 ft. and what are believed to be the last obstacles in the way of the entrance of the Fresno Interurban have cleared away. Instead of going along K street from Inyo to Hamilton avenue, the road will apply for a franchise along Inyo from K to L and then along L to its southeastern limits, thence over private right of way to Hamilton avenue.

TELEPHONE AND TELEGRAPH.

FARMINGTON, WASH.—The council has granted a ten year franchise to Pacific Telephone & Telegraph Company.

EUREKA, NEV.—The petition of the Bell Telephone Company of Nevada for a franchise to operate a telephone line in Eureka has been granted.

KERMAN, CAL.—The German Telephone Company is preparing to construct a line into Barstow colony. The new line will also give service to Biola.

CAULFIELDS, B. C.—Caulfields will be connected with Hollyburn by a new copper circuit 6 miles long by the programme of the B. C. Telephone Company. The line will be ultimately extended up Howe Sound with a view of linking up the Lillooet district.

VANCOUVER, B. C.—The council is considering a recommendation of the municipal electrician that a telephone system be installed in connection with the fire and police departments. Wires are installed and material, including switchboard, telephones, etc., would cost $300.

WATERWORKS.

PORT TOWNSEND, WASH.—The city will have to move its pipe line across the new Portage canal as a letter from the chief engineer at Washington, D. C., has stated that the pipe is an obstruction in the canal.

BOISE, IDAHO.—Twin Falls has filed an application with the public utilities commission asking for a certificate of public convenience and necessity to install within the limits of that city a municipal water works plant. This will be done by taking water from the canals of the Twin Falls Canal Company at a point 11 miles from the city and constructing a new distributing system to accomplish which an election will soon be called to vote on a proposed $300,000 bond issue.

REDDING, CAL.—The tunnel which the Northern California Power Company is driving to carry the water from Burney Creek reservoir to Cow Creek for power purposes is about complete. This tunnel will add 7500 horsepower to the Kilarc and Cow Creek power plants. The tunnel is 8350 ft. long and the reservoir for which it is the outlet has a capacity of 1,306,000 cu. ft., or the equivalent of 30,000 acre feet. The dam which was built to create this reservoir is 1020 ft. long at the crest, 100 ft. wide at the base, 25 ft. wide on top and 56 ft. in height from bedrock. The completion of this work will give the Northern California Power Company approximately 65,000 horsepower of electric energy in this county and a sufficient water in storage to irrigate several thousand acres by utilizing the run-off after the water has been used for power generating. This plan will also act as a practical demonstration of the value of storing the waters of the section during the rainy season. The winter waste is saved and stored and as a result the danger of floods is reduced to a minimum. The power and water resources of Shasta county, according to the United States Government figures, are as follows: Annual flow out of the county, 9,910,000 acre feet; inflow through the Pitt River, 775,000 acre feet, and 559,000 acre feet through the Sacramento River. This vast volume, flowing as it does from the upper altitudes, is capable of generating 1,000,000 horsepower of electrical energy and of irrigating the entire Sacramento Valley if properly regulated and controlled.

ALPHABETICAL INDEX TO ADVERTISERS

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B-2 **Benjamin Electric Manufacturing Co**.....
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B-3 **Blake Signal and Manufacturing Co**.....
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B-5 **Bridgeport Brass Co**..... 3
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B-6 **Berkeley Electric Cooker Co**.....
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B-7 **Busch-Sulzer Bros.-Diesel Engine Co**..... 3
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C-1 **Century Electric Co**..... 4
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C-2 **Colonial Lamp Works**.....
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C-3 **Crocker-Wheeler Co**.....13
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C-5 **Crouse, Hinds & Co**.....
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C-4 **Cutler-Hammer Manufacturing Co**.....
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E-3 **Electric Agencies Co**.....
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E-4 **Electric Storage Battery Co**.....11
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F-1 **Fairbanks, Morse & Co**.....
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H-4 **Holophane Works**.....
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H-5 **Hunt, Mirk & Co**.....
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H-6 **Hubbard & Co**.....
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I-1 **Indiana Rubber and Insulated Wire Co**..... 4
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M-4 **Morse Chain Co**..... 5
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N-1 **Nason & Co., R. N**.....
151 Potrero Avenue, San Francisco.

N-2 **National Conduit & Cable Co., The**.....
Trust and Savings Bldg., Los Angeels; Rialto Bldg., San Francisco.

N-3 **National Lamp Works of G. E. Co**.....
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N-4 **New York Insulated Wire Co**..... 4
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O-1 **Okonite Co. (The)**.....14
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S-6 **Standard Underground Cable Co**.....
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T-1 **Thomas & Co., R**.....
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V-1 **Van Emon Elevator Co**.....
56 Natoma Street, San Francisco.

W-1 **Wagner Electric Manufacturing Co**.....14
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119 East Seventh Street, Los Angeles; 507 Sixteenth Street, Oakland; 680 Folsom Street, San Francisco; 907 First Avenue, Seattle; 45 North Fifth Street, Portland, Ore.

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50-52 East Broadway, Butte; Van Nuys Bldg., Los Angeles; Couch Bldg., Portland; 212 So. W. Temple, Salt Lake City; 165 Second Street, San Francisco; Alaska Bldg., Seattle; Paulsen Bldg., Spokane.

W-5 **Westinghouse Machine Co**.....
141 Second Street, San Francisco.

W-6 **Westinghouse Lamp Co**.....
(See Westinghouse Electric and Manufacturing Co.)

W-7 **Weston Electrical Instrument Co**.....
682 Mission Street, San Francisco.

W-8 **Western Pipe & Steel Co**.....
444 Market Street, San Francisco; 1758 North Broadway, Los Angeles.